Factory
MANAGEMENT AND MAINTENANCE

Vol. 95, No. 1

CONTENTS

January, 1937

Why Factories Will Be Busy in 1937 35
Facts back forecast of better business ahead

Forward with Industry 43
Highlights of Manufacturers' annual meeting

Industry Is Going Forward .....an editorial 49

Labor Shortage? Not Here 50
Enlightened personnel policy the main reason

Wages and Hours Since NRA 53
Report of National Industrial Conference Board

8,500,000 Back to Work 53
According to U. S. Chamber of Commerce

Housing That Workers Can Afford 54
No tiled baths; modest cottages, modest prices

How Industry Is Being "Coordinated" ... 55
Sample of National Coordinator's cooperation

Before You Give the Go-Ahead to Time Study 56
Bear in mind these horse-sense suggestions

Shipping Room Bonus Adds 20% to Earnings 58
Incentives did not stop at shipping room door

The Pipe Line That Moves 60
Biggest materials handling news in many a year

Plant's not Modern; Its Layout Is 62
Old buildings no excuse for antique methods

See Your Maintenance As It Looks on Paper 64
Chance to compare organization charts

You Want to Know 66

If Dust Is Your Problem 67
Electric precipitation may be the answer

They Put Group Drives Under the Floor ... 69
Good solution of old problem in new plant

It's Safer if Grounded 71
Industry wants no electrocutions

Pick Floors for the Job You Ask Them to Do 73
Emphasis this time on composition coverings

Operating Shorts
Chute Was Corrugated; Now Parts Slide.... 75
They Got Together to Cut Costs..... 75
Keeping Track of Tools and Dies..... 75
Nut Tightening Easy with Special Fixtures.... 76
A Testing Panel for the Repair Shop..... 77
Motors Interlocked for Automatic Stopping.. 77
Jack Facilitates Wedging of Stator Coils.... 78
Electric Heaters for Drafting Room..... 78

What's New in Equipment 79

Trade Literature 100

Books 108

FACTORY'S PLANT OPERATION LIBRARY

Recent Electrical Developments ..... S345 — S356 ..... Preceding Back Cover

MASON BRITTON, *Senior Vice-President* L. C. MORROW, *Editor* A. M. STAEHLE, *Manager*
G. A. VAN BRUNT, LEWIS K. URQUHART, *Associate Editors* C. G. SMITH, J. F. ANDREWS, *Assistant Editors*
A. H. MOGENSEN, ARTHUR VAN VLISSINGEN, JR., *Consulting Editors*
H. P. DUTTON, *Chicago* CHARLES B. GORDY, *Detroit* PAUL WOOTON, *Washington*

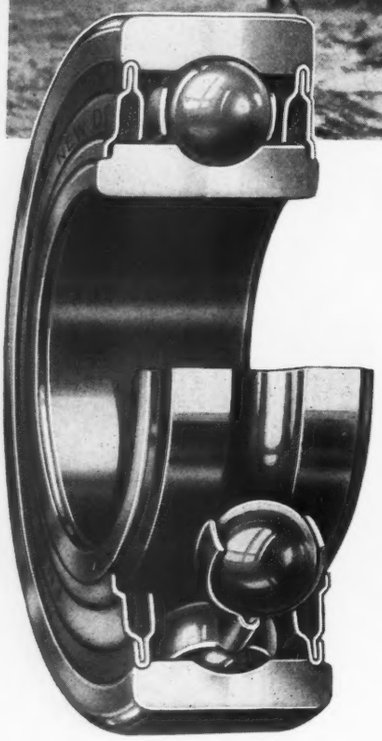
Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering*

Price 35c. a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings. Cable address "McGrawhill, New York." Member of A.B.P. Member A.B.C. Copyright, 1936, by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, January, 1937. Vol. 95; No. 1. Published monthly. McGraw-Hill Publishing Company, Inc. Publication office, 99–129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post office, Albany, N. Y., under the Act of March 3, 1879.

JAMES H. MCGRAW, JR. Chairman — MALCOLM MUIR President — JAMES H. MCGRAW Honorary Chairman
MASON BRITTON Senior Vice-President — B. R. PUTNAM Treasurer — D. C. MCGRAW Secretary

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.



. . . and Lubricated for Life

Seven million N-D-Seals have been put into use since New Departure originated the self-sealed bearing nine years ago . . . New Departure's experience and creative engineering still give the most effective seals. New Departure, Division General Motors Corporation, Bristol, Connecticut; Detroit, Chicago and San Francisco.

another new departure by

NEW DEPARTURE

PIONEER OF SELF-SEALED BEARINGS . . .

N-D-Seals

2506

Factory
Management and Maintenance

Why Factories Will Be Busy in 1937

HOW GOOD will business be? What may we expect for 1937? In attempting to answer these questions, *Factory* has deliberately avoided the usual post-prandial pronouncements of leading industrialists whose wishes might understandably father their thoughts. It has gone instead to the facts that have been uncovered by 20-odd McGraw-Hill publications, and upon the facts it has built a forecast of what may conservatively be said to lie directly ahead of American industry. *Factory* has not attempted to "cover" every industry. Nor has it tried to include all the available data. Only enough have been selected to round out a picture upon which executive plans and decisions for the coming year may reasonably be based.

Suppose we look first at the prospects for general business. One of the important facts we uncover is that about $13,000,000,000 of federal securities are on a short-time basis. Most of this amount has to be funded on a long-time basis some time in the next two or three years. That cannot be done except in a favorable money market; and the money market will be kept favorable, even if it must be done artificially and doing it means inflation of business and money. We may not like it, but there is no other answer to it.

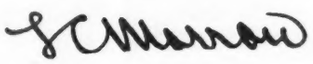
We cannot talk about general business conditions without considering the world picture; despite the fact that politics is probably in as chaotic a state the world over as we have ever known it, the business outlook is good. Even if all the nations of Europe were bent upon war, nobody is ready and there is little likelihood of a general war for the next couple of years. However, everybody is preparing, and that means the consumption of a tremendous amount of manufactured as well as raw materials. If there were a world war, it would mean a fast expansion of our own productive output. If *we* got into that war, there is no end to what would be required in the way of business and industrial expansion.

Associated News Photo

Factories will be busy during 1937. I see three principal reasons to justify this statement. The first is that the pent-up demand of six years has broken loose. During those years obsolescence out-paced replacement and modernization. Now the business of making up for lost time is underway.

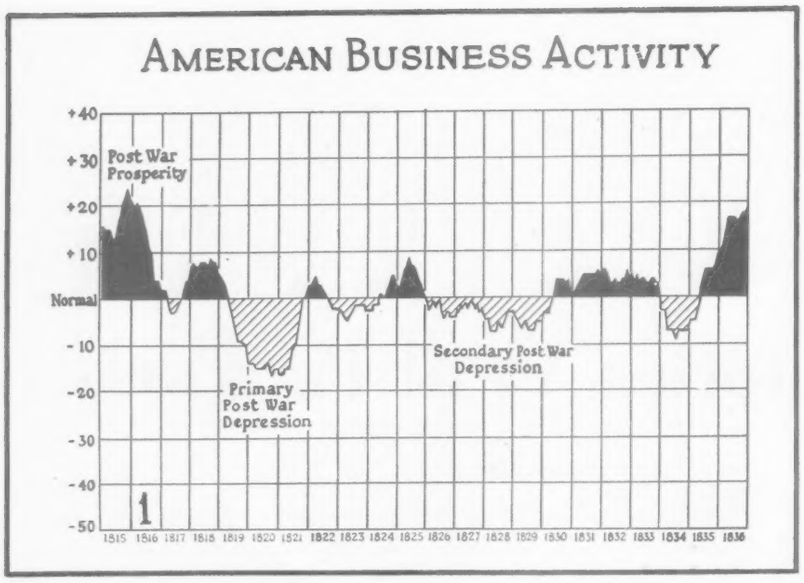
As the second reason I designate the renewed faith of industry in the business cycle. The infallibility of the cycle was questioned when it went lower than ever before. Now it is going up; the dawn has arrived to dispel the nightmare.

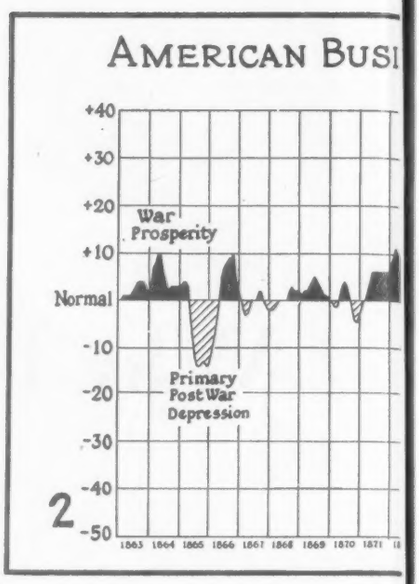
And for the third reason I nominate restored confidence. That elusive yet essential factor is again exerting its benign influence.

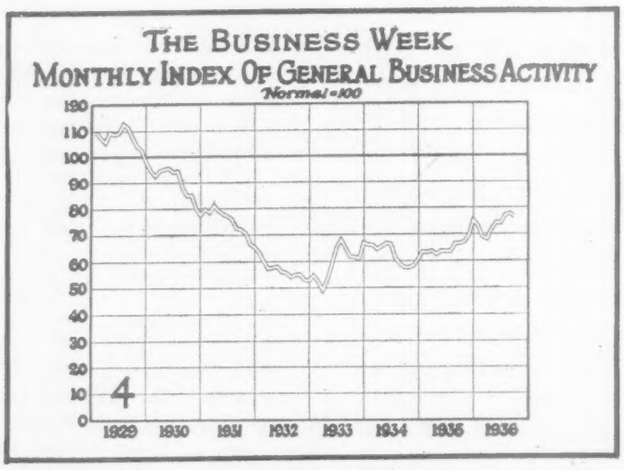


The most powerful influence in the business situation, however, is shown in Charts 1, 2, and 3. They picture the trend of business activity following the three great wars that p a r t i c u l a r l y affected American economy. The War of 1812, the Civil War, and the World War present almost the same pattern. They show post-war inflation, a primary deflation, a temporary recovery, and a deep and long-lasting secondary depression. In every case, the secondary depression was l o n g e r and deeper than the primary one. In every case, once the bottom of the secondary depression was reached, there was a sharp and well-sustained recovery far above n o r m a l, which lasted over a long period of years. Right now we are still below normal but definitely on that long sweep upwards. All statistics and all experience seem to prove this.

Lest we be too optimistic, it is well to bear in mind that even today the *Business Week* general index of activity (Chart 4) is still only 75

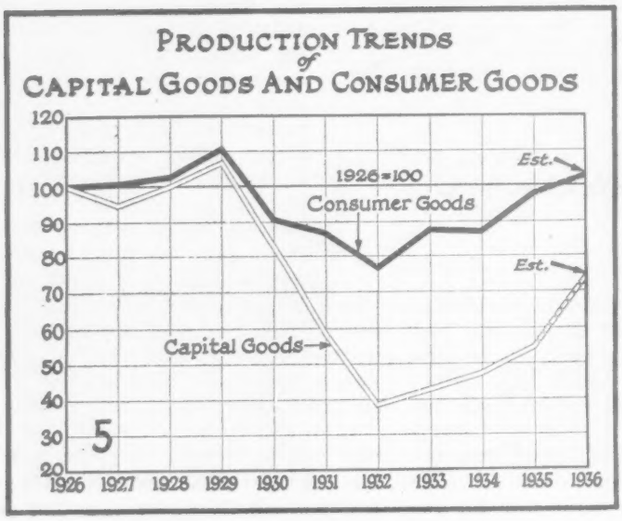






ALL SIGNS POINT to increased business and busier factories in 1937. Lest anyone get too optimistic, however, it is well to remember that business is still only 75 per cent of normal

ANOTHER SURE SIGN of busy plants in 1937 is the relation of consumer and capital goods. Always hit hardest in depression, capital goods come back last, then rise abruptly. Exactly that is happening



RENEWED FAITH in the business cycle is one of the principal reasons for the belief that factories will be busy in 1937. These three charts picture the trend of business activity following the three great wars that particularly affected American economy. All three present almost the same pattern—post-war inflation, a primary deflation, a temporary recovery.

per cent of normal. This is a calculated normal which is supposed to indicate where business would be if there were no fluctuations of the business cycle, due to depressions and booms, and if we took into account growth of population and actual stimulation of industry, by all sorts of industrial improvement processes.

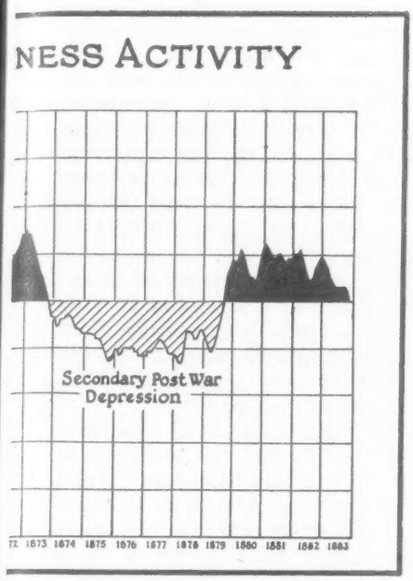
Meanwhile, as is shown on Chart 5, consumer and capital goods move parallel in their outlook. In abnormal times, capital goods always suffer worse. They come back last, then rise most abruptly. That is exactly what is happening here.

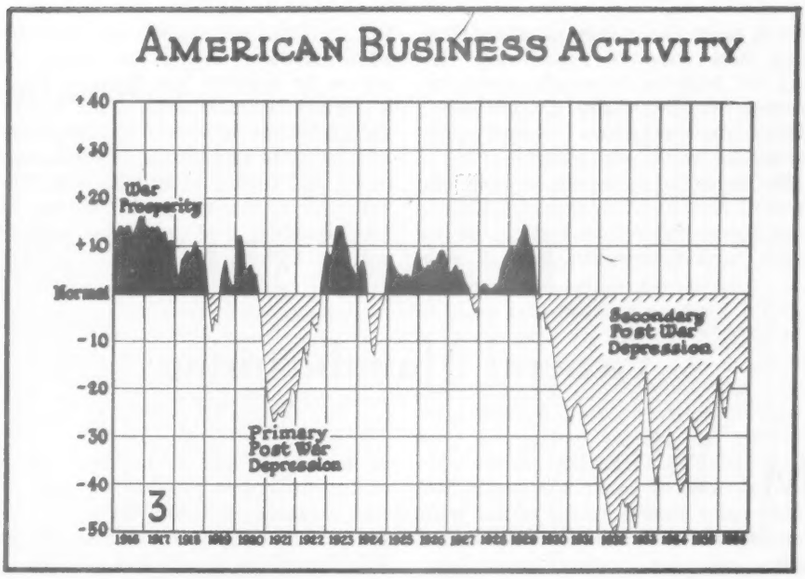
Another assumption is the relationship (see Chart 6) between employment and payrolls, which in normal times is pretty well fixed. We started getting out of step back in 1930, but it was not until 1931 that the disproportion really developed and payrolls took a sharper decline even than employment, despite the fact that we had 11,000,000 or 12,000,000 people out of work. The gap here is now closing.

Another important consideration is the relationship between total income of the nation and farm income. The drop in farm income about 1919 was wholly artificial and almost wrecked the relationship of agriculture and industry. Today the trend of farm income is definitely upward, and the relationship between farm dollar and industrial dollar is more clearly normal today than at any time since 1920.

New Industry to Give Us a Lift

It has frequently been said that we ought to have a new industry to give us a lift out of a depression—one that would capture popular fancy and employ men. As a matter of fact we have one very definitely in air conditioning. First, air conditioning has oppor-





and a deep and long-lasting secondary depression. In every case, once the bottom of the secondary depression was reached, there was a sharp and well-sustained recovery which lasted over a long period of years. Today we are still below normal, but definitely on the long sweep upwards. All statistics and all experience seem to prove this

tunities for expansion that none of us comprehends. Second, it is one of the elements that is going to make present housing obsolete and bring tremendous stimulus to business.

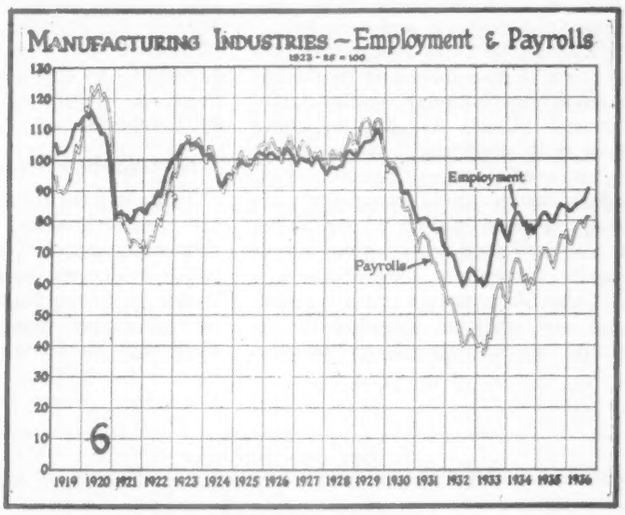
We had such an experience about 1900 when modern plumbing, heating, porcelain bathtubs, and electric lights all came about the same time, and everybody's house was out of date all at once. Air conditioning, elimination of dirt and noise, regulation of temperature, control of moisture, and mechanization of the kitchen are all converging to give us another of those great booms in housing modernization that will make another vast market for America's manufacturers.

50 Billions of Bank Credit Overnight

Behind all this lies a banking and credit situation of staggering potentialities. Chart 7 presents a dramatic picture of the explosive forces that may be released here when confidence prompts men to make use of more money.

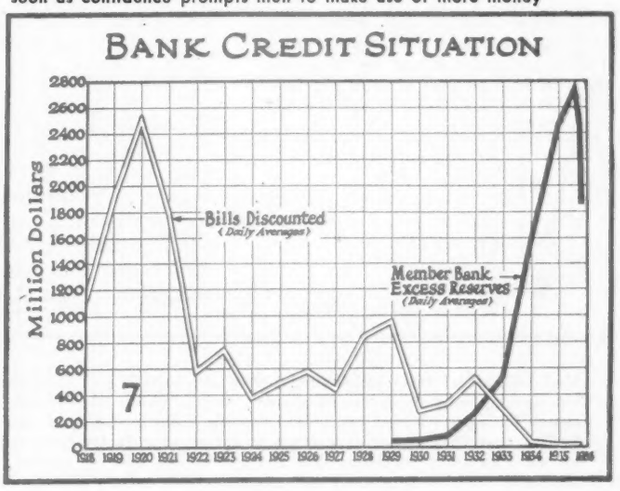
In 1920 the banks had not only exhausted their own resources but had also borrowed $2,500,000,000 from Federal Reserve Banks to finance business. Since that time they have repaid these borrowings, and rediscounts have practically disappeared. With the repayment of the rediscount debt, the banks began accumulating excess reserves, money they had no use for in the normal course of business, until by last August these idle bank funds had reached the staggering total of $2,800,000,000. At that point the curve turns downward, but this is merely a matter of bookkeeping, occasioned by an arbitrary, though wise, increase in reserve requirements.

In short, the banks are about $5,000,000,000 better



PAYROLLS during the depression went into an even sharper decline than employment. Good indication of good business ahead is the inevitable closing of this gap

IDLE BANK FUNDS reached staggering total of $2,800,000,000 in August, 1936. Never mind the sharp decline at that point; it is only a matter of bookkeeping. Note explosve forces to be released as soon as confidence prompts men to make use of more money



off to meet the needs of expansion than they were 15 years ago. In fact 50 billions of credit could be created on this base almost overnight. In emergency further vast expansion would be possible.

We seem to have an irresistible upward surge of business, an administration dedicated to forcing cheap money and prosperity, federal cash and credit to accomplish any end the administration seeks, and bank reserves to support an inflation that is almost inconceivable. Our worry should be not as to whether business will increase and expansion will continue, but rather as to who will control the explosive potentialities of the situation and how the control will be exercised.

General Manufacturing

MANUFACTURERS of durable as well as consumer goods find their sales curves rising along with the curve of general business. Higher sales call for higher production, which in turn calls for plant improvement, addition, and new capacity. Management has recovered from any fears it may have had that technological development spells unemployment (Chart 8), and is going ahead with confidence in its search for more efficient equipment. That modernization and expansion are already proceeding at a gratifying pace, is indicated by a partial list of recently announced expenditures.

Of the 58 manufacturing corporations and utilities included in the list, no one announced expenditures of less than half a million. Most of the programs provide for more—for example, $29,000,000 by U. S. Steel, $25,000,000 by Fisher Body, $14,500,000 by Buick, $14,500,000 by Connecticut Light & Power, $13,000,000 by Standard Oil of N. J., $7,500,000 by Industrial Rayon, $5,000,000 by Chrysler, $5,000,000 by Packard. They total more than $175,000,000.

New Buildings, New Equipment

These expenditures are being made for improvements, additions, and new capacity. Part of the money will go for new buildings; much of it for new equipment. Even much of the money spent for new buildings will go to the manufacturing industries, which normally receive 67c of each building dollar.

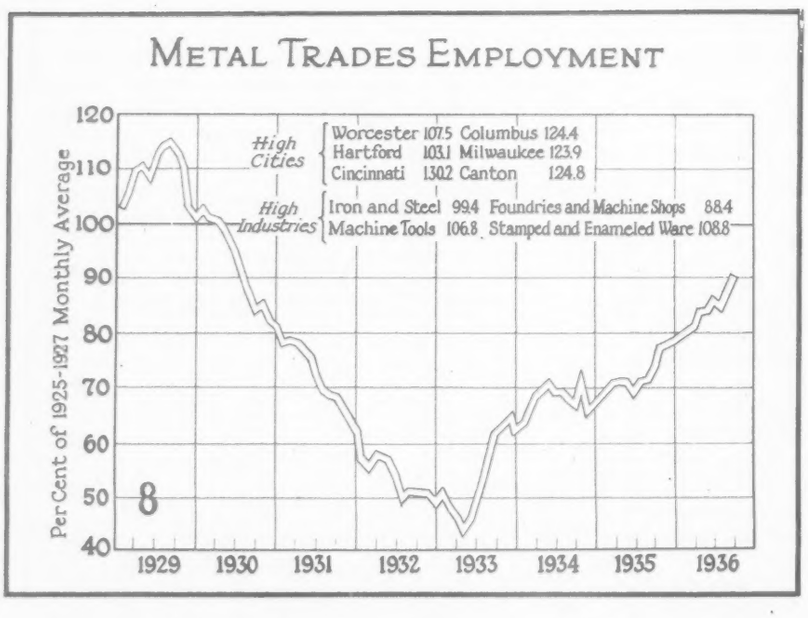
A survey conducted last year by *Power* indicated that 31 per cent of industrial power equipment is less than 10 years old, 35 per cent from 11 to 20 years old, and 34 per cent over 20 years old. In short, 69 per cent is over 10 years old and is either obsolete or open to suspicion of being obsolete. Industrial power plants must be modernized if they are to be operated economically. Here is a $5,000,000,000 market offering potential savings estimated at $1,000,000,000 a year.

In the spring of 1935 *American Machinist* surveyed the condition of metal-working equipment and found that 65 per cent of it was 10 years old or older—in other words, obsolete or subject to suspicion of being obsolete—and that the machine tool industry would have to operate at a rate of 107, on its index curve, to maintain even this unsatisfactory condition. It would have to operate at 179 for 5 years to bring the obsolescence percentage back to 48 per cent, where it was in 1930.

Evidence of the rapid improvement in the machinery industries is given by the *American Machinist* index of industrial machinery which climbed upward until it reached 180 (based on the average of 1935 equals 100) for last June. Assuming that the percentage of obsolescence in all kinds of industrial machinery approximates that for machine tools, there is reason to believe that the present level of activity on the part of manufacturers of this equipment will at least be maintained in 1937 and should be considerably improved.

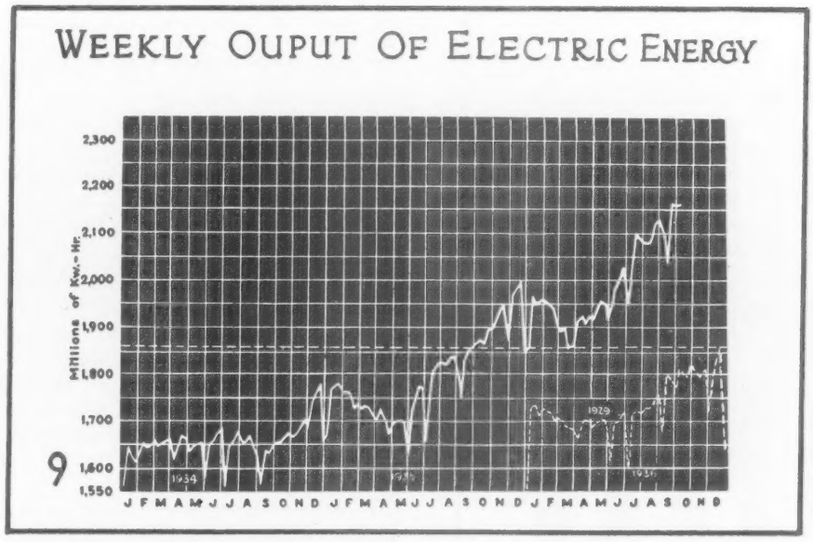
New Materials, New Methods

Why has all this equipment become obsolete? Largely because of the development activity of the companies producing it. They are using low alloy steels that possess high strength in the as-rolled condition without heat-treatment; stainless steels that boast great welding stability; alloys of beryllium with copper; new light alloys; old-resistant synthetic rubber; fiber glass that can be spun into cloth or rope or used directly for heat insulation; new lacquers, new vitreous enamel finishes, new methods of plating, and a variety of rustproofing processes. No matter which way you turn—to the consumer product or to the machine in the capital goods field—the new models are so far superior that design obsolescence has overtaken the old equipment.



MANAGEMENT HAS RECOVERED from any fears it may have had that technological development spells unemployment, and is going ahead with confidence in its search for more efficient equipment. Employment in the metal trades, where technological development has proceeded at a somewhat faster pace than its average for all manufacturing industries, has crossed 90 per cent of normal, and skilled labor shortages are already making their appearance in certain quarters and trades

Electrical Industries



SINCE THE END OF 1934 weekly output of electrical energy has averaged higher than 1929; last October it definitely passed the highest 1929 point. This is due to industrial recovery, since domestic load is only about 10 per cent of the total output. Industry is using more power in relation to product output. To supply this growing demand, the utilities will need to spend a billion dollars a year for the next 10 years. That will help keep factories busy in 1937

THE electrical industry bears a vital relation to industry, commerce, and human life. It is internally organized in four sections—wiring and installation, wholesale and retail distribution, generation and transmission of electrical energy, and electrical manufacturing.

Until the present time new construction has marked the limit of the wiring business. Two new factors have now come in—promotion of more adequate wiring and modernization of obsolescent wiring installations in all types of buildings.

Sales of electrical wholesalers, for the first nine months of 1936, showed a 35 per cent increase over the same period of 1935. Reflected in this sales curve are considerable gains in sales of wiring materials and control apparatus to industrial plants, sales of industrial and commercial light equipment and sales of household appliances.

Electrical appliances were called the "wonder child of the depression" because of a continual increase in sales. Sales in 1936 were up 204 per cent compared to 1929 in units, but are only 35 per cent more in dollars. Manufacturing has been more profitable than distribution. Profits for distribution and increased manufacturing profits will return with new design.

Since the end of 1934 the weekly output of electrical energy (Chart 9) has averaged higher than 1929. This is due to industrial recovery, since domestic load is only about 10 per cent of the total. Industry is using more power per unit of output.

Because of this trend, power use during the next three or four years will increase at a faster rate than in any period of the past. What this means to the utilities is shown by an analysis of the reports of 30 operating companies. They show an average increase of 100 per cent in net income.

To provide for the tremendous and growing demand for industrial, commercial, and domestic power, the utilities will need to spend a billion dollars a year for the next 10 years, or at about the same rate as from 1922 to 1930. Expenditures for transmission and distribution have been increasing during the past 2 years, and this piles up the need for investment in generation.

At $100 per Kilowatt

In the next few years this investment in generation will steadily increase. About 1,500,000 kilowatts of new capacity were added in 1936. *Electrical World* estimates 2,500,000 kilowatts for 1937, or $250,000,000 in commitments.

Electrical manufacturing now approaches normal values. This embraces all types of electrical products and has been influenced considerably by heavy equipment manufacturing, which is 1936 increased 25 per cent over 1935. A further increase of 27 per cent in heavy equipment manufacturing is forecast, which will put the 1937 total up to 85 per cent of 1929 volume.

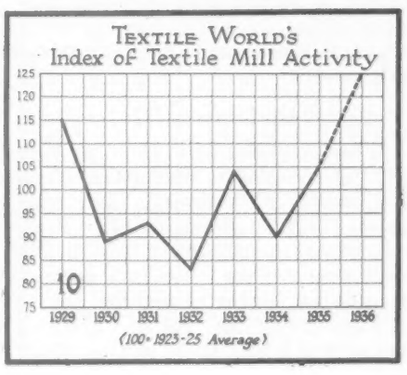
Textile Industries

TEXTILES will finish up 1936 not only as the best year since 1929, but actually about 10 per cent better than that year. The situation is reflected in Chart 10, *Textile World's* index of textile mill activity.

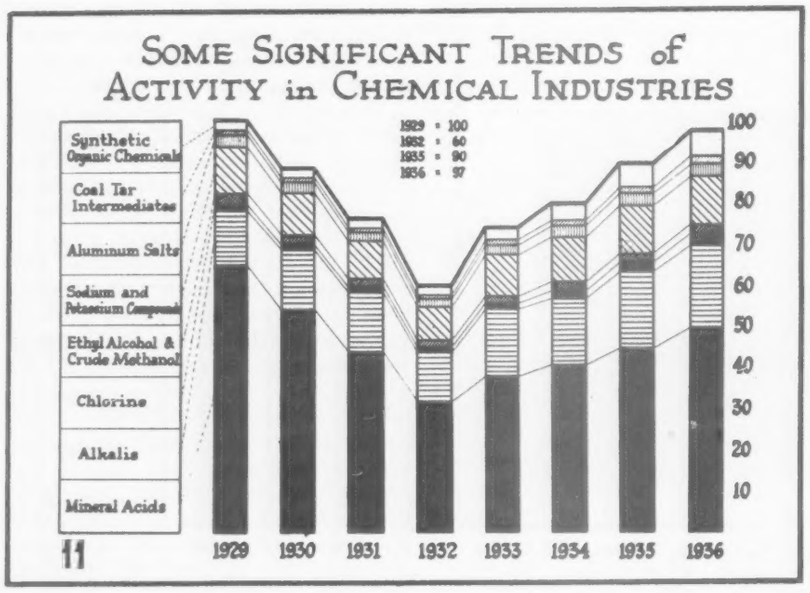
On the basis of the 1923 to 1925 average, 1936 will be 125 as compared with 115 in 1929. Fortunately this increased volume has also been more profitable than that of any year since the depression. Manufacturing margins have improved steadily, particularly during the more recent months, and those who sell to the textile industry have also shared its prosperity.

The year's sales of accessories and supplies to the textile industry are estimated as equivalent to those of 1929. This index (1929 = 100) went down to 39 in 1932, and has now climbed back to par, a splendid record. And in 1937 the activity that characterized the last half of this year should continue.

BEST YEAR since 1929—in fact, 10 per cent better than that year—is 1936's record in the textile industries. And in 1937 the activity that has characterized the last half of 1936 should continue



Chemical Industries



EIGHT MAJOR GROUPS that comprise the greater part of chemical production present an adequate cross-section upon which to base a comparative study of operations. All but two of these major groups—mineral and alkalis—stand at higher levels than in 1929. And there is good reason to believe that they will continue to stand there in 1937

PROCESS industries represent almost a fifth of all manufacturing industries; may be divided into chemical producing and chemical consuming industries. The former are what we normally regard as the more strictly chemical industries; the latter are those process industries that are based on chemical engineering. The analysis of production trends of the more strictly chemical industries shows that the rate of operation in 1936 was at 97, only three points below the production rate for 1929, which was 100.

Chart 11 shows eight major groups that comprise the greater part of the chemical production; they seem to represent an adequate cross-section on which to base a comparative study of operations. It will be observed that all except two of the groups—namely, mineral acids and alkalis—stand at higher levels today than they did in 1929. There is good reason to believe that they will continue there in 1937, perhaps at a slightly accelerated rate in some instances.

Up Seven in '37

When we get to the chemical consuming industries, we have a striking picture of recovery. The composite for 1936 stands at 118. Present gains should put it up to 125 next year. This takes into account significant figures of activity for 14 process industries that are users of the sort of products we saw on Chart 11. Rayon, for example, expanded from 100 in 1929 to 227 in 1936. Paper and pulp rose to 180 in 1936; plate glass to 130; rubber to 117.

The two highest years for new construction in the process industries were 1928 and 1929, when the totals were $82,000,000 and $122,000,000. If the rate shown for the first ten months continues this year, as seems likely, it will be right back to 1928, but still a considerable jump behind 1929. In the present building boom, which seems to be headed well into 1937, almost $20,000,000 worth of new pulp and paper plants are already under construction in Southern states, to cite one example.

Forging Ahead

In short, the younger chemical industries have continued to forge ahead during the depression and the older process industries, dependent on chemical raw materials and chemical engineering methods and equipment, are moving ahead at a striking rate, well in advance of the industrial profession. Meanwhile, new plant construction is under way, as a logical and inevitable result of an evolutionary process.

Food Industries

THE FOOD business is peculiar in one respect. There is practically a constant *per capita* consumption of food, but the penalty for uniform consumption is that the price index shows extreme fluctuations.

Based on a wholesale price index of 100 in 1926 and again in 1929, a steady fall carried the curve down to a low of 60 in 1932 and 1933. Retail prices followed closely, of course, dropping from 110 to 68, but since then both have been rising. The apparent anomaly of wholesale prices higher than retail is not a matter of fact. It is a matter of indices. And this Bureau of Labor Statistics curve is now readjusting itself.

This swing of prices is directly reflected in the Census Bureau's figures on total number of establishments in the food industries; when food prices drop down to such low levels as they reached in 1933, a lot of people are wiped out.

The trend is now upward, and as prices rise more plants will come into existence, just as when they go down the high-cost plants fold up.

Production of manufactured foods is a crazy sort of line. Its bulge in 1934 was largely the result of drought slaughter of livestock. A great many plants that do not ordinarily can meats were working overtime to conserve food that would otherwise have died on the hoof.

Where the production curve will go in 1937 is largely dependent upon the weather and the export market. The 1936 drought was greatly oversold to the public. Imports of raw materials, especially of grain, increased considerably during 1936. By this means many domestic plants were kept in operation that would have curtailed their operations had they been compelled to depend entirely on domestic raw materials. Take it all in all, however, the prospects for the next few years in the food industry are very pretty.

The Extractive Industries

PRODUCTS of the "Extractive Industries" are the raw materials for other industries. They are what you might call dependent industries. They share the general state of business of all industry, because their products must be used by somebody else to be fabricated into other articles. In each case there is a general similarity in the curve of production, a rather steep descent during the depression, culminating in a low ebb in 1932, then a quite sharp rise from that point on with a still sharper rise during 1936.

Coal

From 80 to 85 per cent of all bituminous coal mined is used by the railroads, utilities, and manufacturers generally, so the volume of consumption of coal depends upon the state of other industries. It does not depend on price. The fact is, the production of bituminous coal is looked upon as a very sensitive barometer of general industrial conditions. When you look at the curve of production (Chart 12) you will see that from 1929 to 1932 it went down with all other industries. In 1932 there was a fairly sharp turn, and since then the trend of bituminous coal production has been steadily upward.

Where this is going in 1937 depends upon the activity of other industrials that consume coal. It is doubtful if this line of production, which is now steeply upward in 1936, will continue at that angle. It may level off somewhere around 450,000,000 tons a year, but that is a good base for the bituminous coal industry.

Another trend in the coal industry which is significant, especially for the future, is the fact that the industry has stopped waiting for somebody to come and buy its product and has gone out to sell it.

Gold and Silver

Metals divide into two groups—the precious metals, gold and silver, and the base metals, copper, lead, zinc, and iron. The gold miner and the silver miner have but one buyer, one market, and a fixed price—a rather lovely situation. The copper, lead, and zinc miners have to meet all the rigors of competition. The gold miner and the silver miner are the beneficiaries of the administration's monetary policies. Gold at $35 an ounce brings 75 per cent more than gold at $20, and if you were producing a product for which you suddenly got a 75 per cent premium, you would think you were pretty lucky, especially if there was only one buyer and an unlimited market.

When it comes to the outlook for 1937 in gold and silver mining, however, it is doubtful whether production of gold will continue to increase at the 1935 rate of half a million ounces a year. It will increase, but probably at a lower rate. The high price of $35, however, will probably continue. The whole situation rests in the laps of the political gods.

Copper, Lead, Zinc

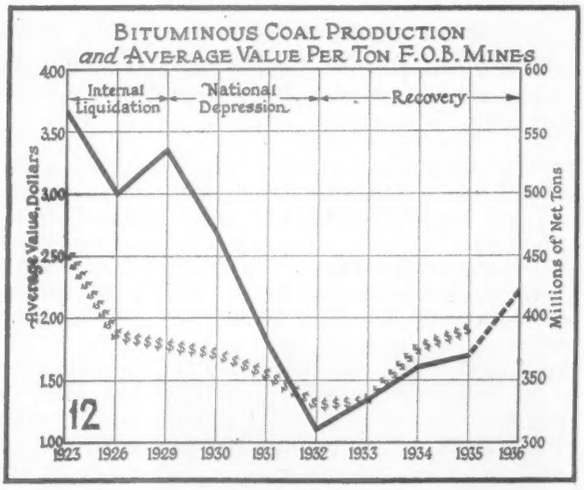
When we come to the base metals we find an entirely different picture. These miners have to meet all the rigors of competition. There are many copper producers and many markets for copper. So as general industrial activity decreased during the depression, the production of copper fell off until 1932. After that it began to rise and has since had a steady rate of increase. Meanwhile, stocks have been reduced; the price has risen. The outlook for the copper industry is very good.

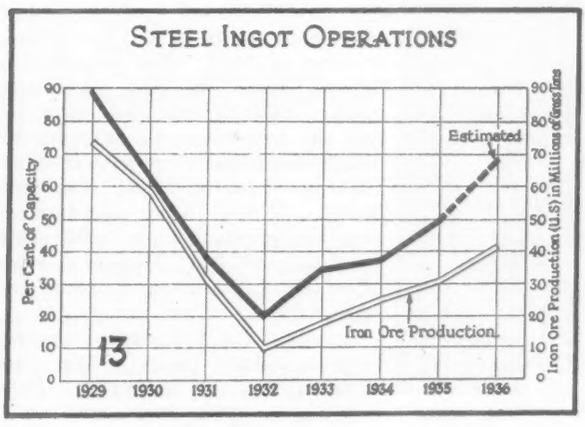
Pretty much the same situation exists with respect to lead and zinc. There is a striking similarity in the production curves for all three of these metals, with a low point occurring in 1932 and a steady upward trend taking place since that time in price, production, and consumption. The outlook for next year is better than it has been for the past four or five years.

Iron and Steel

Iron and steel again show the same curves that are typical of the current trend in the demand for metals. In Chart 13, one line shows the per cent of capacity at which steel mills have been running. The other line represents the production of iron

BITUMINOUS COAL PRODUCTION is a very sensitive barometer of general industrial conditions. Since the low point in 1932, the trend has been steadily upward. It may level off somewhere around 450,000,000 tons in 1937, a good base for the industry

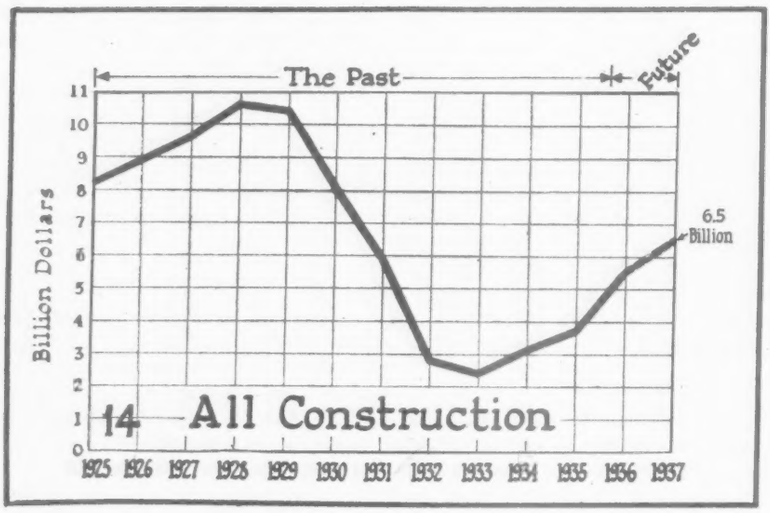



STEEL INGOT OPERATIONS
Estimated
Iron Ore Production
Per Cent of Capacity
Iron Ore Production (U.S.) in Millions of Gross Tons
13
1929 1930 1931 1932 1933 1934 1935 1936

TYPICAL OF CURRENT TRENDS in the demand for metals is the steel ingot curve. Now operating at about 70 per cent of capacity, the steel industry may go as high as 80. Iron ore production can be speeded up at any time to meet the demand for steel

ore in millions of tons. Observe the dip to 1932 and the later upward trend. The steel industry is now operating at approximately 70 per cent of capacity, and probably will hold at that rate. It might go as high as 80 per cent in 1937. Iron ore production, of course, can be speeded up at any time to meet the increased demand for steel.

Construction Industry



ONCE A $10,000,000,000 GIANT, the construction industry was whittled down by the depression. It has come halfway back. Construction moves in long-period cycles. After three years of improvement we are somewhere in the middle of a strong upward trend. Bogey for 1937 is $6,500,000,000. It may be beaten

THE CONSTRUCTION industry was once a $10,000,000,000 giant. But the depression whittled it down. Since 1932 it has come about halfway back (Chart 14).

In 1937 we should like to see $6,500,000,000 of work done, of which at least one-half would be private work. Is it possible?

In 1934 the total was $3,104,000,000. In 1935 it rose to $3,700,000,000; in 1936 to somewhere near $5,500,000,000.

Private work in 1934 accounted for only 24 per cent of the total, the lowest in 21 years. In 1935 the proportion rose to about one-third of the total, and in 1936 we continued a slow but steady rise. For the first nine months private work was 90 per cent ahead of 1935.

May Get Up to Normal

From our present vantage point, therefore, the 50 per cent figure for private work in 1937 seems distinctly possible. And, if the public utilities loose their purse strings for many needed plant expansions, something really startling will occur. We may even get up to normal, when private work accounts for two-thirds of the total, and in that event our $6,500,000,000 bogey would be exceeded. There seems no question but that it will be attained, since only a 20 per cent increase is needed.

Home building has such potentialities as a business stimulator that it must not be ignored, for a housing boom seems an absolute certainty. Most of the figures quoted on the housing shortage are gross exaggerations, because they contain a lot of hoped-for slum replacement and prefabricated housing, which experience shows us will not occur—at least in 1937. But conservative figures based on past experience gives a startling enough picture. Before the depression, we built 400,000 new housing units every year. Since 1931 we have averaged less than 50,000. With a 75 per cent increase over the previous year, 1936 registered only 140,000. Here is a deficit of nearly 2,000,000 units—five normal years.

Housing for industry—industrial buildings—has been rising, and shows no signs of letting up. From nothing in 1932, it is now up to $260,000,000 (Chart 15), which is only half of the 1929 peak but probably about 75 per cent of normal.

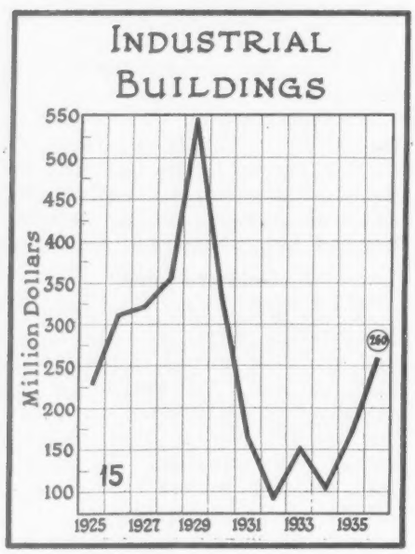
There is one other development that we should like to see—maintenance of public works at somewhere near a $3,000,000,000 figure, but a shifting of the major financial burden from the federal government to the states and cities where it belongs. Federal participation in local work has shown a definite tendency to diminish, and there are fortunately signs that the trend will continue.

The present $3,000,000,000 total is a high figure, practically the 1927–31 average, and therefore one cannot prophesy too definitely. However, federal work will continue to be substantial, and there will be a "federal emergency construction appropriation" for 1937, although it will be closer to $1,000,000,000 than to the $4,800,000,000 of 1935.

A Strong Upswing

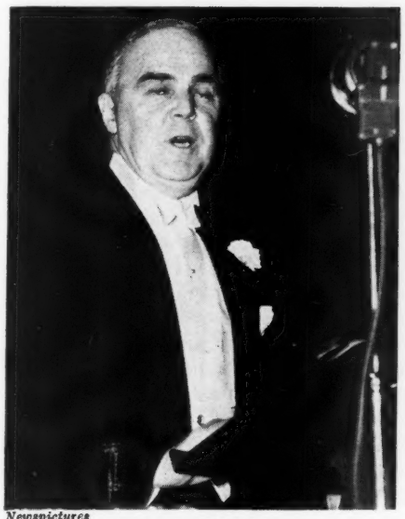
Construction moves in long-period cycles. After three years of improvement we are about halfway along in a strong uptrend. Physical volume of construction in 1936 will stand at 80 per cent of 1926 or 1931, and 60 per cent of 1929. Although still behind many other industries, construction is today in a far sounder condition for advance than at any time in recent years. Its financing is returning to normal, and very soon its planning for future improvements should also return to normal.

FROM NOTHING in 1932, industrial building is up to $260,000,000—only half of the 1929 peak, to be sure, but probably 75 per cent of normal



Forward with Industry

Forward to a higher standard of living and to industrial peace, says National Association of Manufacturers—backs its objectives with constructive Principles for American Industry and a sound program of employee relations



Newspictures

C. M. CHESTER
Chairman, General Foods Corporation

AMERICAN industry exists to supply people with the things they want; producing goods and selling them at a fair profit. We cannot get more by producing less. We cannot get more by dividing the same amount of work.

Multiplying products — creating more things — this is the American formula of prosperity.

Nothing is any more germane to the happiness and welfare of every American than the fact that there is being created a new abundance for all to share. An increase from 53½ billion dollars paid out in 1935 to an estimated 62-billion-dollar national income in 1936, of which the worker in 1935 received 67.3 per cent, compared to 65.5 per cent in 1929, is a national achievement of outstanding note.

Employment in member firms of the National Association of Manufacturers today stands at 106 per cent of the 1929 level. Six per cent more workers than in 1929!

According to U. S. Census figures there are about 41,000 fewer concerns to employ not only the same number of employees as in 1929, but an estimated 4,434,000 that have become employable since 1929. These figures reveal that the firms which have been able to survive the terrific ordeal from which we are emerging have not only been able to attain their 1929 level but have surpassed it.

But industry is not going to barricade itself behind statistics or stop at the 1929 level of employment. Our job is to absorb all of the unemployed possible—to bend every effort of science and management skill to create still more jobs—and at the same time more of the comforts of life for the American people.

Industry's Responsibilities

1. Industry must accept its responsibility for national welfare as being an even higher duty than successful operation of private business.
2. Continue to fulfill its obligations to the public of making better goods at lower cost, thus raising standard of living and keeping the door of personal opportunity open.
3. Put every possible employable in manufacturing industry back to work.
4. Keep its own house in order, exposing its policies at all times to public scrutiny.
5. Stand four-square against monopoly in any form.
6. By its actions engender growing confidence on part of workers.
7. Invite increasing public understanding by telling the facts.
8. See that workers, management, and investors, according to their contribution, share fairly in the proceeds of manufacturing.
9. Help to create economic security for all, preserving as well the opportunity for the individual to attain his own greater security.
10. Zealously live up to its responsibilities and insist that all other factors of our economic life, including labor organizations, be made equally responsible.
11. Make its cooperation available to government in a constructive manner at all times.
12. Join other business groups in studying the depression in order to minimize or avoid another one.

New Horizons for America

AS BUSINESS MEN, let us ask ourselves specifically what these fellow citizens of ours want. Our job is to supply those wants—not what we think the customer should want or what we think would be good for him—*but what he wants.*

It seems to me that these aspirations of our fellow Americans are really very simple and very definite:

1. They want work.
2. They want more money.
3. They want still more leisure.
4. They want security against unemployment now and against poverty when they are old.
5. They want more *for* their money —more and better things at lower prices.

That is all. Five things these customers of ours want. How many of the five can business supply? In what measure? That is the ultimate test of our business system.

Here is a challenge and a new opportunity for service to the nation. Sometimes we forget that the sole purpose of business—its entire reason for existence—is *service.* Profits must not be the end of business, but

Newspictures

LEWIS H. BROWN
President, Johns-Manville Corporation

The four addresses presented here are in abstract—Ed.

merely a measure of a service that has been well rendered.

In business and industry today I sense a new leadership and a new feeling of responsibility. We are again *pioneers*—not fighting the forest or seeking to wrest from nature a hazardous existence, but fighting now to make America not merely richer, but a *better* place in which to live. And for our pioneering we can have as our reward from these grateful customers, all the profits we *deserve*.

If the American system of private enterprise is permitted to function unhampered, there will be possible still higher standards of living and a new era of abundance such as would have been undreamed of only a few years ago. This is the goal which American business must keep constantly before it. Only this can provide the new wants of the American people.

Two courses lie before us. One runs a tortuous path to the inevitable crash from which no one can gain or prosper. The other leads to even brighter horizons—both for industry and for America.

Which course shall we take? There can be no question as to which one is more desirable, but to steer the right course requires skill—leadership—cooperation between *all* groups—government and industry alike. There must be willingness to meet fresh problems with open minds and to effect, without delay, the readjustments that a changing age demands.

Industry Must Speak Constructively

Newspictures

ERNEST T. WEIR
Chairman, National Steel Corporation

INDUSTRY fills a double function. It is a maker of goods. It also is an *exchange* through which the worker trades the products of his specialized skill for the other products that he needs. There is hardly a person who would have anything but praise for industry's performance of the first function—that of making goods. Now it is demanded that industrial leaders improve the second function—that they develop industry so that its efficiency as an exchange will equal its efficiency as a maker of goods, and thereby improve industry's social function as they have already improved its technological function.

This seems to be the essence of the popular feeling today. It explains popular support of certain legislation which politicians have enacted and attempted to enact. It explains a frequently heard but inaccurate statement that the American people now distrust industry. The American people are sold a thousand per cent on *industry*. They know that industry provides both goods and employment. But I believe there is a disappointment with *management*. Our American way of life rests on an economic foundation. Throughout our history our real leaders have been economic leaders. The people have instinctively looked to those leaders—or management—to provide them with the opportunity to work, to acquire goods and savings, and to be secure in them.

When huge numbers were deprived of work, of savings, and of security, many felt that management had failed them, and doubted the ability or inclination of management to provide these things. They searched for other solutions and turned to other leaders. They showed an increasing tendency to favor political action. I do not believe that most individuals rationalized this to themselves. It was an emotional thing. They were hurt and they believed management responsible.

Some of the Blame Merited

Many were in the mood to believe what some eagerly seized the opportunity to tell—that management, or industry, or "big business" was entirely and designedly responsible for all the economic ills of life. We need not dwell on the injustice in this accusation. You know what you have gone through in the past few years. It is only fair to admit that some of this blame was merited. But, in most cases, business men were shot at simply because they were visible targets.

Unjust though this has been, the sensible thing is to realize that a public state of mind has been created which will continue to have a tangible effect upon business. Mere resentment on the part of business will not change it. It presents a practical problem. It should be handled in a practical manner . . . which means action and words, not just words.

Four Steps Industry Can Take

Several steps suggest themselves. First, whatever is wrong in the present actions and policies of industry, industry should be the first to recognize and correct. Second, whatever is right in industrial action and policy should be retained and defended against all odds. Third, within industry's limits and in accordance with sound principles, industrial leadership should now attempt constructively to influence human conditions surrounding production. Fourth, industry should keep the public fully informed of its actions and policies. It should speak constructively.

Higher Prices Dangerous

HAROLD G. MOULTON
President, The Brookings Institution

WE NEED no new industries to pull us along the road to recovery. All our existing man power and productive plant are needed simply to restore the customary conveniences of life to the American population as a whole.

Industrial production is still some 10 per cent below the level of 1929, notwithstanding a 5 per cent increase in population. On a per capita basis we are, therefore, well below former levels of production and—it follows—of consumption.

To restore pre-depression standards of production and living will

Newspictures

Candid camera caught these three presidents at Manufacturers' meeting. Left to right, Malcolm Muir, McGraw-Hill Publishing Company; Dr. Harold G. Moulton, The Brookings Institution; Walter J. Kohler, Kohler Company

require a vast expansion of productive activity. In the durable goods industries we shall have to produce at the rate of approximately 33 billion dollars annually from 1937 to 1941 to re-establish per capita production (and consumption) on the pre-depression plane. Our actual production of durable goods in 1936 was only about 21 billions, while the 1925-29 average was about 25 billions.

Facing a Labor Shortage

Such an expansion of production would require the full-time work of from 8 to 9 million additional laborers. At the same time a considerable increase in output of nondurable goods would also be necessary if we were to restore the 1929 per capita level. Hence the production requirements on the basis of present working hours are more than sufficient to absorb the entire volume of existing unemployment.

Further sharp reductions in working hours might bring about a serious labor shortage. Moreover, if the policy of shortening hours in proportion to increasing efficiency were adopted, it would mean that the volume of production and hence of consumption would be permanently frozen on existing levels.

The standard of living of wage earners can be raised only by increasing the spread between wages and prices. Improvement in the ratio of wages to prices depends fundamentally upon increasing efficiency of production. Only inconsequential increases in wages can be achieved by trenching upon profits. The primary requirement for an improvement in the wage-price ratio is increased output through acceleration of technical advances, improved management, increased labor efficiency, etc. Any practices or policies that tend to work in this direction are economically sound; any that work in the opposite direction are unsound.

Profits that result from an expansion in the total volume of production are soundly based; those arising out of price advances are essentially speculative. Profits thus derived tend to be offset by the shrinking purchasing power of those whose incomes from wages, salaries, or investments are not expanding proportionally. Rapidly rising prices may accelerate the increase in production and give rise to an industrial boom. But since the buoyant activity that results merely from increasing prices is not accompanied by corresponding increases in purchasing power, it is not self-sustaining.

Inasmuch as the present recovery movement thus far has not generated a period of rapidly advancing prices, the purchasing power of the industrial working population has been expanding in proportion to the recovery of production.

Further Advance Threatened

But we have arrived at a stage in the recovery movement where further advance is threatened. Increasing taxes, rising prices of important raw materials, and pressures for further substantial increases in wages are exerting a powerful pressure in the direction of price advances. The doctrine seems to have been growing that the *happy* way forward from here is to step up prices all along the line—thereby making more money for division between share owners and workers in dividend and wage bonuses.

The drift in the direction of higher prices of manufactured goods is the gravest danger we face today. Whether forced, irresistibly, by increasing costs, or embraced as a means of stimulating rapid expansion, it is the sure road to an inflationary boom with its spiral of rising prices, wages, costs, and again prices.

An increase in the volume of production would no doubt be stimulated for a time, and in any event large speculative gains would be realized. On the other hand there would be a great increase in industrial unrest, resulting from the rising cost of living. Not the least significant result would be the changing ratio of industrial to agricultural prices, and the consequent renewed efforts to use the machinery of government to protect the relative position of the farmer.

Industry and Its Employees

Complete report of N.A.M. Committee on Employment Relations

INTERRUPTIONS in production due to labor difficulties are frequently caused by the lack of proper provisions in an organization by means of which a sufficient understanding of the problems of management and men can be mutually arrived at, causes of complaint removed, and misunderstandings avoided.

Following an intensive survey of employer-employee relations in

American Industry, the National Association of Manufacturers believes that there is no specific plan, formula, or procedure in the field of employment relations which can satisfactorily meet the varying conditions and problems of different plants in different industries and communities, but we believe that satisfactory relations between management and employees will result from application of the following fundamental principles:

1. A mutual respect and consideration by each for the problems and viewpoints of the other.
2. Promotion of the widest understanding that the greatest measure of well-being for both employers and employees, and maximum possibility of obtaining the full economic value of their services lie in the development of the common enterprise in which they are engaged.
3. Free interchange of ideas between management and employees in all matters and company policies of mutual interest, such as wages, hours, and conditions of employment.
4. Opportunity should exist in each plant for the consideration and adjustment of all complaints, and for appeal to the highest executives.
5. Development by each company of a sound and well-defined employment policy.

The following practices and policies have been found in many plants to encourage the development of sound employer-employee relations. It is felt that these policies merit careful study by all manufacturers even though some of them may not fit the conditions in individual companies.

Wages

1. A general wage level, at least equal to the wage level for similar work and conditions in the locality; the wage for each job being determined, relatively with other jobs in the plant, with due regard for skill, responsibility, experience, physical demands, and hazards.
2. Use of adequate wage incentives, where they can be fairly applied, as a reward for individual or group effort.
3. Fair standards of performance which can be reasonably and consistently attained, with no change of such standards unless a material change has been made in conditions, methods, or equipment.
4. Wage plans sufficiently clear to enable the worker to determine promptly the money due him.

Hours

1. A general standard of working hours fully consistent with the welfare and health of employees considering the type of work and providing for seasonal demands or emergencies. It should be recognized that an average work day of eight hours, with at least one day of rest in seven, is now quite general.
2. Adequate advance notice whenever practical to employees of any change in the schedule of hours of work.

▼ ▼ ▼

INVESTMENTS in trained personnel are beyond the tax collector's reach. Dollars invested in apprenticeship training develop men who are just as valuable an asset when the need for them arises as cash in the bank or the highest credit rating.

WARNER SEELY
Secretary, Warner & Swasey Company

▲ ▲ ▲

Working Conditions

1. Maintenance of good working conditions; personal conveniences which appeal to the self-respect of employees; proper lighting, ventilation, and workroom temperatures; and a high standard of orderliness and cleanliness.
2. Prevention of accidents by every practical means, including systematic safety inspections, safety devices, instructions to employees regarding safe practices, strict enforcement of safety rules, regular inspections for fire hazards, proper equipment and training for fire fighting.
3. Encouragement of all employees to make suggestions for the improvement of methods and working conditions.
4. Occupational disease hazards inherent in the working materials or work processes should be controlled and safeguarded so that employees are as far as possible protected from any injurious substances or conditions which cannot be eliminated.
5. Adequate explanation to supervisors before announcement of company policies on matters affecting wages, hours, and working conditions.

Promotion, Transfer, Lay-Offs, and Discharge

1. Build up versatility and flexibility in the working force by encouraging transfer of employees between departments and fill vacancies from within the organization wherever possible; consideration given to training present employees to fit them for promotion. Promotion or transfer on the basis of ability and merit recognizing seniority of service if other factors are equal; in the case of lay-offs, consideration should be given ability and merit.
2. Adequate advance notice whenever practical to all regular employees it is necessary to lay off.
3. Discharge based only on just cause with full explanation to the discharged employee; final decision to discharge an employee made by the superintendent or manager on the recommendation of the foreman; where there is an industrial relations or personnel department, it should arrive at or at least concur in any final decision.
4. Interview of all employees voluntarily leaving the company's employ to ascertain their reasons, thus facilitating correction of any unsatisfactory conditions which might be found to exist.

Assignment to Different Rated Job

1. When an employee is transferred to a higher rated job and fully qualifies, he should receive the established rate for the job to which he is assigned.
2. When an employee is transferred to a lower rated job he should be informed of the reasons for his transfer, and payment of the established rate for the job to which he is transferred. Consideration should be given to the retention of the higher rate when the transfer is temporarily to a lower rated job.

Hiring

1. Delegation of the responsibility for the interviewing and selecting of employees to one person or department, final choice resting with the department head under whom he works.
2. Preference in hiring to former employees with consideration to the following factors—ability, merit, and length of previous service.
3. Make preliminary physical examinations by qualified physicians of all new employees in order to select and place them on jobs for which they are physically qualified, and also to have a record of their physical condition at the time of entering the company's employ. Provide also for periodical physical examinations of employees as occupations and working conditions may require.
4. Follow-up of all new employees to make sure they are being properly fitted into the organization and can qualify as regular employees.
5. Employment of no person under 16 years of age except on temporary work during school vacation periods, or of any person under 18 years of age on any job recognized as hazardous; with these exceptions, age of itself, in all ordinary processes, should not be a bar to employment.

Protection Against Risks

1. Cooperation with employees in making provision for the needs arising out of death or old age and disability due to ill health or accidents.
2. When new processes or machinery are introduced, employers should consider the effects of their introduction on employment; should train the workers affected for other work in the plant; and, if termination of their employment is absolutely necessary, should give as much notice as possible, and should consider providing a special dismissal compensation related to length of previous service and age.

Stabilizing Employment and Earnings

Management should make every effort to stabilize employment related to irregularity of work, and in this connection should study the annual wages of employees in relation to their hourly earnings and the number of days per year the plant operates.

Personnel Records

Adequate employment records should be kept, including a suitable record of follow-up and appraisal of employees and such records should be retained.

Declaration of Principles for American Industry

Adopted at the annual convention of the National Association of Manufacturers

▼

Basic Principles of American Industry

BETTER living, better housing, more of the necessities, comforts, and luxuries of life, steadier work, more certainty of a job, more security for old age—these are the natural desires of every human being. They are the progressive objects of American industry.

Economic and Social Accomplishments

The American business system has made possible the striking continuity in the rise of our standard of living. Since 1850 the American people have enjoyed:

An increase in the share of national income going to wages and salaries from 38 per cent in 1850 to 54 per cent in 1909, and to over 65 per cent today.

A sevenfold increase in average individual wages per hour from 9 cents in 1850 to the highest in our history today.

A decrease in average weekly working hours from 69 in 1850 to the present standards.

A great increase in the average living standard—things our parents never had, more than our grandfathers ever had—new and better things at lower prices, with more wages to buy them.

Today's Tasks and Challenge

But even in view of these significant attainments, to which business has made such important contributions, new opportunities and responsibilities exist that challenge industry to even greater accomplishments in the future. We believe that the greatest future progress is possible under a competitive, private enterprise, profit and loss system, which permits reward to the individual in proportion to his achievements and the risks incurred. It holds out to every youth the incentive of opportunity and assures America of constantly new horizons of achievement.

Patterns for Progress

From an economic standpoint manufacturing industries exist to produce and distribute goods and services so that the entire people have a living and so the standard of that living may constantly be raised. From a social standpoint manufacturing industries, as all business, perform a valuable social function in providing an opportunity for growth and development of the individuals engaged therein and service to mankind.

Industry must continue to improve its employment relations, machines, production methods, and distribution so that all of the people may get more of the things they want at relatively low prices.

Through betterment of these industrial processes, coupled with the correction or removal of trade deterrents and abuses, employment and purchasing power will be constantly increased and our competitive business system be enabled to operate more effectively. Such accomplishment means that the social objectives of individual health, happiness, comfortable homes, education, and security will be realized in greater measure.

Industrial Interrelationships

While industry is only one segment of production and distribution, it is definitely related to the whole of society. Ours is a society of interdependent and cooperating groups of widely differing economic activities. Just as the manufacturer and all who are employed by him provide a market for the farmers, so do the farmers provide an indispensable market for the manufacturer. The farmer is one of the first to benefit as industry is able to produce better goods at lower prices. The manufacturer tends to prosper when the farmer prospers.

New Methods for New Conditions

Machines change. Methods change. Goods change. Desires change. Social conditions change. Industry recognizes the necessity for constant changes in these fields as we move ahead. But in this constantly changing world there are fundamentals inherent in our economic and social system which do not change.

These require that there shall be no artificial barriers to the equality of opportunity for the individual to progress from one economic level to another; that there shall be no fixed rigidities which will prevent the small plant of today from becoming the industrial leader of tomorrow, and that individual initiative shall not lose the impetus and inspiration that has brought our people to their high standard of living.

Protection Against Monopoly

We oppose any monopoly in production, distribution, or labor which restricts or stifles competition and which imposes a burden of unfair high prices on the consumer. A well-informed public should differentiate between mere size and monopoly.

Elimination of Abuses and Bad Practices

We condemn any undesirable practices and abuses in industry and pledge vigilance on the part of industry to bring about their correction.

Reducing Industrial Unemployment

Employment in manufacturing industry has been brought back to within 10 per cent of the 1929 level. Industry should and will continue to do its full part to provide work for those not yet absorbed by private industry as far as manufacturing capacity and demand will permit. We believe that manufacturing industry should give careful study and effort to enlarged or new methods of producing goods and services, so that employment may be increased.

Industry must give careful consideration to problems arising out of temporary dislocation of labor due to improvement in machines. Since there is an actual shortage of skilled labor in many trades, industries, and communities, we believe both employers and educational institutions immediately should increase apprentice and shop training and establish improved vocational courses.

Curbing Depression Effects

We recognize that recurrent depressions and business cycles have enormous effects, both international and domestic, upon the volume of employment, fluctuations in wage rates and weekly earnings, price changes, shifts in purchasing power, taxation, governmental borrowing, and speculation.

Adequate data upon these effects becoming procurable, business, together with other economic groups, has an obligation in studying the whole field of recurring depressions and business cycles in an endeavor to curb and mitigate their violent effect upon the social order. We pledge our part toward such an effort by American business.

Functions of Government

The true function of proper government, as declared by the founders of the American system, is to protect the individual in the exercise of his rights. When this is done, economic and social progress is assured through individual initiative, responsibility, and advancement.

Industry pledges its cooperation with government in the promotion of economic and social progress. Constructive criticism is always forward-looking and particularly desirable in a democracy. It is only through such friendly exchange of views that relationships can be maintained between government and business which will serve the country most fruitfully.

Government Competition

Government competition with private industry is injurious and unsound. Public business is financed by taxation and as such should not compete with the private enterprise from which such taxation is drawn. Where emergency conditions have led to governmental assumption of extraordinary responsibilities, care must be exercised to prevent such emergency agencies from becoming permanent government-owned businesses that compete with private enterprise.

Economic Security

We are in favor of creating economic security for each citizen without limi-

tation of his individual opportunities and responsibilities for creating such security for himself. This means provision for the needy aged, sick, disabled, and unemployed, the last named on the basis that will not make this provision preferred to gainful employment.

We are doubtful that the Federal Social Security Act will attain the very human goal of individual security it seeks. We will cooperate, however, in every practicable way toward making it effective, both in its administration and in constructively amending it. For many years industry has increased the number of privately established plans for meeting problems arising from old age, sickness, disability, and unemployment. Where such plans exist or may be developed, legislation should encourage their retention and expansion.

Industry believes in economic security; it believes even more, however, in preserving economic freedom for the individual—opportunity for the employed worker to have increased job security as the length of his employment increases; opportunity for the worker to advance and obtain promotion in the plant; opportunity for the worker to obtain a financial interest in the company which employs him; opportunity for the worker to save and invest; opportunity for him to rent or buy a home at a reasonable price.

Labor Relationships

Labor, management, and investors should each receive from the proceeds of manufacturing a fair share according to the contribution made. We believe that through full and free cooperation between management and employees based upon mutual understanding a just division of rewards can be attained. We believe in and support the right of labor to seek, secure, and retain employment without regard to membership or non-membership in any organization and to bargain, without interference or coercion by anyone, either collectively or individually. We believe in the correlative right of the employer to be free from coercion by any one.

Against Child Labor and Sweatshop

Child labor in manufacturing industries has decreased steadily during the past half century until those under 16 years of age employed in manufacturing today number less than 1 per cent of all employees.

We have been, and are, unequivocally opposed to child labor as well as to sweatshops in manufacturing. We will support appropriate legislation to eliminate these abuses.

Hours and Wages

Under our industrial system wages have been raised, working hours lowered, and living standards at the same time have greatly advanced. This has been made possible by improved methods in manufacturing, in agriculture, and in the service industries. We believe this improvement will continue under the American system of free enterprise and that wage and hour changes will be made as the improved production methods make them possible. Should arbitrary reduction of working hours limit necessary production, the unavoidable increasing cost will reduce the consumer purchasing power which we desire to enlarge.

We dedicate ourselves to further improve methods to the end that the advance may continue both in working conditions and in living standards.

No equitable yardstick has yet been developed by which to fix nationally industrial hours and wages, since economic factors vary in different parts of the country.

Financing for Progress and Stability

American industry welcomes the administration's current moves toward a balanced federal budget without higher taxes and the projected reorganization of government agencies in the interest of efficiency and economy. With the passing of acute emergency conditions it is proper that greater attention should now be given to effecting greater progress and stability.

Government very properly should take through taxation from the income of production, as from other sources, such portion as is necessary to perform economically the constitutional functions imposed upon it. If too large a share of the income from production is drawn by taxation, production costs rise, consumption slows down, and the constructive effect of expanding economic activity upon our standard of living is seriously retarded.

Adequate financial reserves are necessary for progress and stability. It is a basic responsibility of business to build up reasonable reserves during times of prosperity so that business may operate and combat the forces of depression whenever they set in. No penalty should be imposed upon just financial allocations set aside for emergencies and expansion. Reserves are indispensable to progress and stability and as such should be encouraged and fostered.

We offer our full cooperation to the Federal Government in working out tax procedures that will accomplish these equitable objectives.

Speculative Investments

Industry, and consequently employment, grows through expansion made possible by long-term investment.

Such investment, though often speculative, performs a needed function in our economic life. Mere stock market gambling, however, is seriously detrimental to business stability and frequently endangers the savings of thrifty citizens. Such speculation in securities may change their market value without changing the volume or economic value of the goods they represent. We are opposed to such manipulation.

Foreign Trade

We desire to advance our trade with foreign nations.

This association has steadily supported improvement in our foreign communication service and the development of our merchant marine. The ability of American business to engage in foreign trade in times of peace requires uninterrupted transportation by sea and by land, which rests upon the constitutional responsibility of the Federal Government to keep open the channels of international commerce.

Tariff

Our domestic market is the largest and most important free trade area in the world. The entrance requirements to it should be based upon differences in the relative cost of foreign and domestic production, thus protecting the living standards of American wage earners.

Obligation to demonstrate the need of adequate protection under such conditions rests upon those who seek it. Tariff rates necessary to provide adequate protection vary as the facts change.

The best means of securing such facts for flexible adjustment is through a qualified, non-partisan, semi-judicial tariff commission, operating in cooperation with the President. No change exceeding 50 per cent should become effective without ratification by the Congress.

Reciprocal Treaties

For over forty years the National Association of Manufacturers has favored reciprocal tariff agreements.

We believe such agreements should be negotiated with specific countries, with corresponding benefits to both the United States and the foreign country involved, and that such agreements should be ratified by the Senate. We believe continuance of the unconditional most-favored-nation provisions is inconsistent with the theory of reciprocal truth. They extend the benefits of reciprocal tariff provisions to those not parties to the agreements, giving the benefits and getting nothing in return. We urge that as in all other nations the employee, employer, and agricultural groups most affected by proposed commercial treaties should be afforded opportunity for consultation during their development, respecting the terms and progress of negotiations which may profoundly affect them.

Industry Wants Peace

Industry thrives only on peace. Although the immediate profits of war appear to be spectacular, the costs of war not only wipe out these profits but add to them a mountain of losses. The progress of American industry is an evidence of the fruitfulness of peace—peace at home—peace with all nations.

Still New Horizons

American industry, continually pioneering in new fields, has always taken risks because of the hope of a reward for honest effort. We are still only at the threshold of our economic development and can continue to take the risks of the pioneer provided the door remains open for individual opportunity.

Pledge to Advancement

To continue to advance toward better living, we, as manufacturers, pledge to the future our skill, our efforts, and our resources.

We pledge our cooperation to government—local, state, and national—in the furtherance of those measures which will promote the best interests of the American people.

Prosperity for a nation depends on productivity and peace. Productivity can be destroyed by internal dissensions, by labor conflicts, and by wars. Industry seeks an era of good feeling.

EDITORIALS...

Industry *Is* Going Forward

MOST NEARLY representative of a cross-section of industry is the National Association of Manufacturers. Last month this association at its annual meeting revealed the present-day thinking of industry. Its two days of speeches and committee reports culminated in a "Declaration of Principles for American Industry."

These principles do two things. They constitute a fair and constructive statement of the economic relationship between industry and national welfare; and they lay down a path for industrial management which, if followed, will lead to the objective of a more satisfactory life for everyone.

From the meeting we may draw several important conclusions: (1) Industry recognizes its social obligations; (2) leaders of industry are rapidly adopting the philosophy that the future of industry lies in a constantly increasing standard of living, to be brought about by an increasing spread between wages and prices; (3) liberal policies on employment relations, long held by progressive individual industrialists, are becoming widely adopted.

As we interpret industry's conclusions at this annual meeting, they are something like this:

The social obligations of industry are perforce bound up with industry's objective of a higher standard of living and with employment relations.

Unless workers have incomes large enough and steady enough to permit them and their families to buy industry's products, neither industry nor its workers can prosper.

To enable workers to have sufficient incomes to enjoy a rising standard of living, there must be an increasing spread between wages and prices.

The most certain method of increasing the spread between wages and prices is to reduce selling costs by reducing production costs, which in turn are reduced by taking advantage of every technological development in manufacturing methods and production equipment.

Loss in production due to labor difficulties increases manufacturing costs, and thereby retards progress in the wage, price, and standard-of-living balance that industry has set out to achieve. It is therefore incumbent upon management to do everything in its power to bring about continuing harmonious labor relations.

To a part of industry these conclusions represent nothing particularly new. They are conclusions that have been held by a considerable number of leading companies for a long time. The interesting thing is that they were advanced at the Manufacturers' meeting by so many speakers; also, that they were approved by men representing so large a part of industry.

Does all this indicate a change of heart on the part of industry? We think it represents rather the leadership of those men in industry who for a long time have believed in the things the Manufacturers are now advocating. We think it means that industry now sees as its job ahead the achievement of a higher standard of living, and knows how the job can be done.

Something Out of Kilter

MANUFACTURING industries are facing a critical shortage of skilled men. This, with 8,500,000 still unemployed, provides an anomalous situation which, as Warner Seeley, Secretary of The Warner & Swasey Company, put it to the National Association of Manufacturers, is clear evidence that "something is out of kilter in our way of doing things."

Something certainly is. And it can all be traced back to industry's abandonment of employee training programs in the face of depression difficulties. Here and there it is picking up where it left off. But too many plants aren't doing a thing. Either they don't realize how serious the situation is, or else they don't know how to proceed.

Yet there is no mystery about training. No large plant will find the job impossible. And the need for skilled workers in any group of small plants provides the bond that will unite them on a community basis, assuming that someone takes the necessary leadership.

To those about to tackle this job, we commend the efforts of concerns like Mr. Seeley's—or, for instance, those of the Caterpillar Tractor Company, whose wholesome attitude toward employee relations in general and apprentice training in particular is described in the immediately succeeding pages.

Labor Shortage? Not Here

Reason why is because this company runs an apprentice school that is one of American industry's better efforts of its kind; because it is such a "swell place to work" that skilled workers stay with it. Its recipe for wholesome employee relations is one that any concern can follow

ARTHUR VAN VLISSINGEN, JR.
Consulting Editor

From the experience of Caterpillar Tractor Company

ANY MANUFACTURER who has tried to hire any considerable number of really skilled mechanics has already discovered that there just are not enough to go around. The depression years have played havoc with the supply. Many have moved away; probably more have gone into other lines of work which they do not care to give up. Anyhow, the condition exists in practically every industrial community of importance.

An interesting commentary on the effectiveness of its personnel and training program is that Caterpillar Tractor Company of Peoria, Ill., has not been very hard hit by this situation. To be sure, its employment has crossed 10,000, some 2,000 above the pre-depression peak. Its plants are using just as large a proportion of skilled workers as ever. But this concern has been fortunate in having most of its men available when called back—and this applies to the unskilled as well as to the skilled workers. The company has an unusually low rate of labor turnover, and keeps turning out a steady supply of skilled mechanics through apprenticeship and other educational courses. But the greatest of all these reasons is that its people stay with it rather better than might be expected from nation-wide statistics.

Folks who have worked there for a few months somehow tend to become chronic Caterpillar employees. They express surprise, sometimes, at their own settling down. A Caterpillar plant executive tells of overhearing one workman talking to another recently. The man said:

"This sure is a good place to work. They treat you right. It's the first place ever I felt they really wanted me to get a square deal. Say, did you know I'm moving over to a service department job next week? That's what I've been wanting right along, and they called me in and gave it to me. Yeh. Sure is a swell place to work."

The fact is that practically the entire community — Caterpillar executives among the rest — seems more than a little convinced that it really is a "swell place to work."

"We who have the responsibility of operating the business and the plants certainly do our utmost to make it a swell place to work," explains the same executive. "We do this because we think it selfishly pays the company to have its people in the frame of mind exemplified by the man already quoted. From time to time we have had rather definite evidence that this is a sound management philosophy. The current situation, in which we find ourselves with an almost adequate supply of skilled artisans, is just one of a series of equally convincing occasions.

Four Tries

"Our personnel policy may be set forth in a very few sentences. We try to select people of the desirable sort, preferably those with ambition and ability. We try to make it easy for them to fit into whatever niches seem to them individually most attractive. We try to pay wages a little better than the market. Beyond this, we try to keep ourselves out of the workers' affairs, remembering at all times that once they earn the wages the money belongs to them and it is none of our business how they spend it, with the single reservation that we prefer that they spend it in ways that will not interfere with their delivering the work they are paid to perform."

If this personnel policy as defined sounds rather informal and comfort-

"We try to select people with ambition and ability. We try to make it easy for them to fit into whatever niches seem to them individually most attractive. We try to pay wages a little better than the market. Beyond this, we try to keep out of the workers' affairs"

able like an old shoe, so are the methods and machinery that have been set up to carry it out. Caterpillar has a personnel department and the requisite men to head it up; they likewise are convinced that the best way to get results is to go about it rather less than formally — but with full determination to do a good job none the less.

For example, promotions and transfers. Employees are requested about twice a year — through some such method as posting a notice on the clocks — to notify the employment manager if they have any particular desires to work into other kinds of jobs or other departments. This is so thoroughly understood among the workers that a steady trickle of letters come into the employment department from people throughout the organization.

When a Vacancy Occurs

All such letters are kept on file. The files are set up according to departments and classes of work. When, for instance, there occurs a vacancy in the ranks of the traveling service mechanics, the employment department turns to the service mechanic letter file, pulls out the sheaf, and goes into action. Perhaps there is a preliminary sorting to make sure that no obviously unsuitable individuals are included. Then the letters go to the department head who needs a mechanic. He looks them over, along with the service records of the men. He tells the employment department which men he wants to see, the employment department makes the necessary arrangements, and a few days later some fellow who has apparently been marking time on a machine job in the plant is able to rejoice that this, after all, *is* a swell place to work and that now he is becoming a service man.

Probably Caterpillar is not the only plant on earth to use this idea. Certainly the plant carries it rather further than do most concerns. In any event, the company certainly has some results to demonstrate how it works. Practically every one of the production executives started out at a factory job in the ranks. The vice-president in charge of manufacturing did, so did the general factory manager, the factory manager of the tractor division, and so on. As is well recognized by students of personnel work, probably the most costly loss to employers through labor turnover is the departure of top-quality men who see no future ahead of them. Certainly this cannot apply very strongly at Caterpillar. So very many promotions have occurred, so large a proportion of all people in jobs above the lower levels have come from the ranks, so plainly is the worker's technique for getting himself promoted or transferred un-

The door for advancement is wide open at Caterpillar. Dozens of graduate apprentices are now foremen. Many have gone higher. Jimmie Monroe, who is signing this boy's graduation certificate, was an apprentice 17 years ago. Today he is factory manager of the tractor division. On the desk is a $100 set of tools, the company's gift to each graduate

K. P. Crowell, general supervisor of apprentice training, presents the facts of slipstick operation in a big way. More than 300 students are taking the Caterpillar apprentice course. The yearly grist from this mill assures a constant supply of skilled mechanics, builds up a reserve of man power from which most of the foremen and supervisors of the 1940's will undoubtedly be drawn

derstood, that any man with sufficient intelligence to offer any prospect of promotion must see for himself a good future right with his present employers.

Nor is the benefit of this attitude derived only from holding the best 10 per cent, the men who have possibilities of really going places in the organization. You cannot disregard the effect upon the ordinary fellows who have never made much progress and never will make much because either they are entirely content to remain where they are or else lack some of the qualities essential to getting ahead. These men and women are genuinely convinced that at Caterpillar they have a better chance than they would have in most plants, so they are not inclined to go looking for greener pastures.

Door Wide Open

Moreover, and this is tremendously important, they hold confidence that they get a square deal, that they have had at all times just as much promotion as they were entitled to. In other words, because the management holds the door for advancement wide open and in plain sight of everybody, even those folks who do not make their way through it appreciate its being open and give better, more loyal service in return.

Mention has been made of the nation-wide shortage of skilled workers. Caterpillar has been materially better situated in this respect than a good many firms. A major reason has been that these people stay, do not leave in anywhere near the proportion that is common in many industrial plants. Another reason is that this company has consistently trained its own skilled workers.

The Caterpillar apprentice school is one of the better efforts of this kind in American industry. It has, in the past dozen years or so, graduated more than 200 skilled mechanics — the kind of men who make real toolmakers, diemakers, pattern makers. A few months ago the management could proudly say that 99 per cent of these graduates were still with the company, because at that time there were two of the boys who had left and gone to work elsewhere. Today they say even more proudly that every man who ever went through the apprentice school is working for the company; the two wandering sheep tried it elsewhere, made good records in their jobs— the employment department checked up on them with a good deal of interest, to see what other plants think of their training — and finally came back and asked to rejoin the Caterpillar payroll.

Scaling the Heights

Jimmie Munro is the prize exhibit. Jimmie went through the apprentice school before it was anywhere near so well set up as it has been for these past 15 years, but despite this handicap he became factory manager of the tractor division just a few months ago. It took him 17 years to climb from freshly hatched journeyman to one of the biggest jobs in the manufacturing organization. And the firm made quite a to-do about his promotion, just because it completed the first cycle of apprenticeship to executive rank. This was signalized not long afterward when Munro signed the apprentice school certificate of the first man graduated after his promotion to signing rank.

These graduate apprentices are spotted all through the plant, with some in the offices for good measure. As this is written, and before this is published, one of the graduate apprentices is being promoted to foreman of the tractor plant's diesel engine assembly line over which Munro

Six years ago Charles A. Woodley was a Caterpillar apprentice. Now he is a foreman in the tractor plant. Here he is showing one of today's apprentices how to make a piston. These graduate apprentices are spotted all through the plant, with some in the offices for good measure. One was recently made foreman of the tractor plant's diesel assembly line over which the new factory manager of the tractor division used to preside

used to preside. Literally dozens of them have foreman jobs, many have gone higher. Some, of course, may always prefer to remain highly skilled mechanics.

The details of how the apprentice school is operated do not belong in this article. But the way it functions in producing men who fit into the promotion program is certainly pertinent. At present the school has more than 300 students, most of them taking the four-year courses, a few in the three-year pattern-making course. The school takes them in at any time that a vacancy occurs, graduates them when they are ready rather than in classes. A goodly grist is coming out in the next year, which is one reason why the plant is not so hard pressed for skilled men as it might be. Don't let anyone tell you that a boy who has gone through this hard-boiled apprenticeship course is anything short of skilled, even though he may be only 20 years old.

There are other school groups in the company, including one that takes newly graduated engineers—the cream skimmed from the senior classes of some of the best engineering colleges—and puts them through a course to make them really useful, practical parts of the organization. There are sales schools and service schools, but these are not part of the manufacturing division. However, they are worth citing as showing that this is a viewpoint that pervades the entire company.

A Chance for Everyone

It would be possible to fill several more pages with details of Caterpillar personnel and wage policies. Many paragraphs could be consumed in telling how the management continuously checks its wages not only with local wages but also with employers of recognized generosity throughout the entire Middle West and throughout the tractor industry, then sets up its own wages whenever there is any sign of the rest catching up. It would be easy to string together the hundred-and-one little touches of helpful services to employees at no tremendous cost to the company, such as providing roofed-over parking for employees' cars free of charge, and offering heated garage space at less than cost. But all these are things that can be found either duplicated or represented by equivalent touches in the procedures of most employers who realize that the best and least expensive labor policy is one that produces a genuine satisfaction with the company and with the job.

After all, such things as these are less important to the development of the proper personnel relations. Caterpillar executives feel that the most important are the determination to give every individual a chance to work himself into the best job he can fill, and the methods employed to make sure that this usually occurs as planned.

"For our people really do know that they can get ahead with Caterpillar if they can get ahead anywhere," explains one of the men close to the top. "They know that we all want them to climb, that we have as our ideal the old-fashioned theory that when a president has to be replaced it should be done by hiring a new office boy or taking on a new apprentice and moving one long string of employees a notch upward. They see all around them first-hand examples of folks who have really made substantial progress from rather unpretentious starts with the company.

"This, we feel sure, is a major reason why working for Caterpillar becomes a chronic habit with an unusually large proportion of all the people who get on our payroll. It is a reason why they feel that 'this is a swell place to work.' And it is correspondingly significant as a cause for our ability to get the kind of labor we need even now when so acute a shortage exists in some highly skilled classifications—not to mention, of course, the effect of having good, loyal, contented people all pulling together to help one another make our company the leading manufacturing concern in its field."

Changes in Wages and Hours Since NRA

AVERAGE hours worked per week in manufacturing industry have increased slightly since the end of NRA, but are still below the average of 40 hours a week set as a minimum for most industries in NRA's effort to spread employment.

This fact is brought out in a study of conditions during and subsequent to the NRA period which has just been made public by the National Industrial Conference Board. Interest is now centered on changes that have occurred since the NRA was declared unconstitutional, the Conference Board points out, in view of the possibility that some of its provisions may be re-enacted.

During the NRA period the work week averaged 35.6 hours. Following the declaration of the Act as unconstitutional, there was a sharp increase due chiefly to lengthening the work week for workers who had been on part time. As a consequence, average hours worked per week increased to 37.0 for the period from June to December, 1935. The increase in 1936 was slight. For the first nine months the work week averaged 38.6 hours.

Hourly earnings today are practically the same as at the end of NRA. It is important to note, however, that during the NRA period they advanced nearly 42 per cent. Employment has increased since the end of NRA and now stands at 86.5 per cent of the 1929 level as against an average of 75.1 per cent of the 1929 level during the NRA period.

Because of the increase in hourly earnings and the lengthening of the work week, weekly earnings are now 15 per cent higher than the average for the NRA period. Real weekly earnings, or the purchasing power of wages, were 6.4 per cent higher in September than NRA's average.

•

8,500,000 Back to Work

ACCORDING to a report of the U. S. Chamber of Commerce's Special Committee on Employment, 8,500,000 people have been re-employed in business and industry since March, 1933. At least 3,000,000 have been put back to work since May, 1935, which shows a steady increase in employment.

The number of unemployed who if employed would find their places in business and industry is placed at the present time as under 4,000,000. The Chamber's Committee, in submitting its own estimates, makes it clear that this figure applies only to those normally employed on wages or salaries, and that it has no reference to unemployed farm labor or the unemployed among the professional classes. It includes those now on government relief work.

Housing That Workers Can Afford

No tiled bathrooms, to be sure. Just modest prefabricated housing designed to fit the pocketbooks of ordinary workingmen. Geo. A. Hormel & Company's housing project not only paid its own way, but also kept employees busy in a slack season. Inspiration here for numberless concerns located in communities where the housing shortage accumulated in depression years is acute

LEWIS K. URQUHART
Associate Editor

MOST industrial housing projects produce houses that are rather more elaborate and expensive than the factory worker can afford to purchase within a reasonable period. They tend to cost him too much for interest, thus diverting too large a share of his available money from paying off the principal. Or else the organization that provides the houses has to absorb a substantial loss on each—a criticism to which many of the current federal housing projects have been open.

Double Problem

In the spring of 1935, Geo. A. Hormel & Company, meat packers of Austin, Minn., faced a double problem. First, the shortage of dwellings that had accumulated during depression years had left rents high and living quarters crowded. Second, shortage of animals arising from the previous summer's drought and from federal crop restriction measures had brought a shortage of work in certain of the departments, notably the packing and crating.

The management put the two problems together and used them to solve each other. Crating department people could, under proper guidance, do a lot of carpentry work in constructing houses. If these houses could be built cheaply enough and still be substantial, they could help to provide adequate housing for plant employees. Plans were therefore developed for standard panels and framing parts that could be prefabricated in the plant and then hauled to the site.

In planning these houses, the real purpose was kept always in mind. To be sure, it would be nice if employees could have tiled bathrooms and mechanical refrigeration. But most of them had gone through some lean years. Many of those who most needed houses had little or no cash beyond their weekly pay checks. Therefore it was decided to provide minimum housing, which the worker could pay for at rates he could afford. The workman who bought such a house and paid for it in a few years would then be in position to add to it as his needs and pocketbook might permit. Moreover, the houses were so planned in pre-fabricated panels that about all the owner would need to do would be remove the battens at the joint, unscrew the panel, and put it back on the outer wall of his addition.

Two Weeks to Erect

The houses are one story, all on low-priced lots. The smallest house is 192 square feet, the largest 416 square feet. They vary in size from kitchen, bedroom, and toilet, up to several rooms. The final cost of the buildings ran from $358.16 to $1669, and they were all proportionate to the buyer's ability to pay. The first few were sold at prices that showed a loss, primarily because the production methods were not yet perfected. The last few yielded a small profit.

Once the panels had been fabricated in the crating room, they were erected in unbelievably short time at the site. It was usual for the owner to take possession less than two

Home of Mr. and Mrs. Walter Nemitz, Austin, Minn. Nemitz is a janitor at the plant of Geo. A. Hormel & Company, in whose crating room the panels were pre-fabricated. Original cost, exclusive of lot, $1,040. Three tons of coal kept it "almost too warm" last winter

weeks after the house was ordered. From there on, it was his problem.

Financing was taken care of through the local banks, which took the loans pretty much on the basis of salary loans. This is written some fifteen months after the first houses were sold, and in that time the collection experience has been about the same as with other small loans. There have been a few small temporary defaults, chiefly arising from such causes as illness or other unforeseen expenses, but these have all been straightened out by the home owners, and are either paid up or are being paid up in regular installments. An idea of the financing may be gathered from a typical better house of this group—living room, bedroom, kitchen, toilet. It costs its owner a few dollars over $1,000, which he is paying off at the rate of $4 weekly.

In a few of the houses, more particularly those of the first batches, some slight imperfections have appeared and have been remedied by the company if they were jobs that the owner could not handle himself.

Recently the owners held a meeting and chose four representatives to confer with the management. The first impression was that some serious dissatisfaction might have arisen among the owners. When the spokesmen were talked with, it turned out they wanted to work out some method by which the company would help them finance storm windows throughout. Likewise, several had small defects to mention. As one of the spokesmen said: "Some of my windows aren't very tight, and I want to tell you about 'em. Of course, if the company doesn't want to fix 'em, I'll do it myself."

Proud of His House

This same man, asked how he felt about his house, waxed eloquent with all the pride of ownership in the world, and said he thought all the other owners felt the same way.

Because most of these houses are on the outskirts of town, the land was cheap, and generous lots cost from $100 to $300. Most of the lots are large enough to provide large gardens. Already some additions have been made to the houses, and the owners are busy putting in gravel driveways and erecting portable garages.

The Hormel housing development is significant not because of its size but rather because it is a commonsense approach to the problem of providing houses at costs that ordinary workingmen can afford. It is based on horse sense, not on theoretical consideration of just what living standards should be observed by a given wage level of the population. The only theory involved is that of providing the best possible value at a price level that the worker can afford. He can improve and expand the house later as he can afford to do so. Meanwhile, he is actually becoming a home owner and getting something more substantial than rent receipts. He gets his roots in the soil of his home town as a substantial citizen, taxpayer, and property owner. From this start, the rest is up to him.

How Industry Is Being "Coordinated"

S. D. KIRKPATRICK
Editor, Chemical & Metallurgical Engineering

PURPOSELY, we waited until after election to publish this editorial, although it was written early in October. Our reason is that it deals with a certain malpractice in governmental administration in Washington which we hope will no longer be regarded as a political issue. We refer to the use by the "Coordinator for Industrial Cooperation" of the official statistics of the Census of Manufactures as the basis for a wholly unfair indictment of chemical industry.

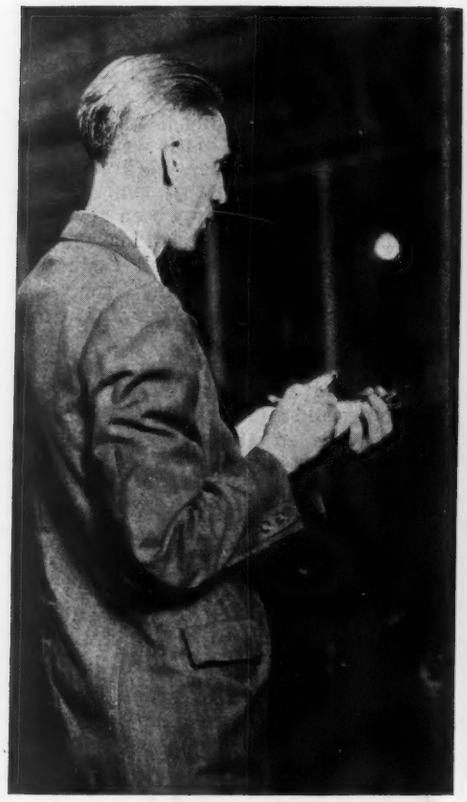
The obvious purpose of this governmental activity is to incite the wage earner to turn against the employer and to demand a larger percentage of the value added by manufacture. Word has already come to us from far distant parts of the country showing how these reports are being used to promote organization and unionization by stirring up trouble and discontent among workers in chemical plants. With such objectives in mind it did not take a particularly clever statistician to distort the official census figures into showing that chemical industry is the lowest of all industrial groups in the percentage of the value added by manufacturing which is paid out in wages—19.2 per cent in 1933 as compared with 36.2 per cent for all industry. No mention is made of the fact that the average annual wage for chemical industry in 1933 was $931 as compared with $869 for all industry. Nor does the report point out that due to the inherent nature of chemical manufacturing, labor is a much less important factor in the total cost than is true for other commodities. That technical supervision, heavy plant investment, and rapid obsolescence are all proportionately higher seems to have escaped the "Coordinator."

Deliberately Misleading?

His report, however, would have the wage earner believe that he is entitled to an increase in pay directly proportional to his productivity as measured by the ratio of the number of workers to the total value added by manufacture. Using this hypothetical figure for his index, the "Coordinator" notes that in 1914 the chemical "wage earner's productivity was 77 per cent greater than that for all industry while his average wage was 4 per cent less, and the percentage added by manufacturing paid in wages was 45.8 per cent less than for all industry." Therefore, the "Coordinator" concludes that "if the (chemical) wage earner had received an average yearly wage comparable with his greater productivity (or 77 per cent greater), his wages would have increased 85 per cent over what he did receive." This can be true only when you reason from the false premise that labor alone was responsible for the tremendous increase in productivity in chemical industry. What about the contribution of salaried employees, of modern chemical engineering processes, plants, and equipment?

There are many other fallacies in this report which any chemical engineer or executive will be quick to spot. But for the uninformed, who is willing to accept unchallenged its superficial air of impartiality, it can prove grossly misleading. We are convinced that its distortion of facts is too great to have been unintentional. We can only conclude, therefore, that it is a deliberate attempt on the part of a governmental agency to stir up class hatred and promote trouble and discontent.

Before You Give the Go-Ahead to Time Study



Spreading the work—that uneconomical but humanitarian measure adopted by industry during the depression—sounded the death knell of many a good time-study program. Now, as industry returns to normal production methods, management may listen with profit to these horse-sense suggestions

JOHN D. RELYEA
Superintendent of Manufacturing
Maxwells, Limited, St. Mary's, Ontario

ALTHOUGH time-study technique is now pretty cut and dried and much has been written about special rate-setting stunts, there is mighty little "experience" information on file for the manager who is up against the double necessity of reducing payroll and boosting production at the same time. This is a common condition right now, with many plants that abandoned time studies during the depression entering a new period of intense activity along these lines.

It is common to hear a man say that his plant has slacked off on time study, and is now only 50 per cent on piecework—an erroneous statement. If he has time-study figures on only 50 per cent of his operations, he might as well be on daywork. With mixed piecework and daywork, operators "squeeze" piecework and pad daywork time.

Assuming that management has squared up to the problem and wants direct action, it is necessary to have definite foundations to build on before an enthusiastic rate-setting department can be given a free hand.

Broadly, the elements of a good time-study program are:

1. *Line-up of operations*—Operations must be listed or carded, so that operators as well as payroll, methods, and time-study staffs designate the same operation by same name and number.

2. *Standardized base rates*—Prevailing local rates generally determine the rate that must be paid for each class of labor. It is essential to classify all plant operations, and decide what base rate will be paid for each. It is often practical to have as few as six divisions — namely, laboring work, boy labor, female labor, ordinary productive, semi-skilled, and skilled labor.

3. *Rate routine*—Method must be set whereby new prices will promptly be made known to operators and payroll department. Rules should be made to protect time-study observers, so that they are not saddled with the job of giving out rates to operators.

4. *"Prompt result" standards*—Rules should be laid down so that incentives (roughly 6, 8, or 10 per cent) can be determined from a minimum number of readings. Provision must be made to eliminate trucking, sorting, and set-up times from studies of operations.

5. *Guaranteed rates*—Operator confidence is won if management guarantees that new rates will not be cut for a definite period.

6. *General rate cut*—A blanket cut seems easy, but is not desirable because if many rates are loose they are also bound to be variable, out of line with standardized base rates. A general cut would only result in further inconsistency, let alone the bad mass reaction produced.

7. *Diversified authority*—Haphazard rate setting must be eliminated. As for planned progress, all rate changes must come through one central authority. Spasmodic setting of rates by foremen must be forgotten.

8. *Notification of new jobs*—This is a sore point even in normal times. Much heartburning may be avoided by a definite ruling at the start that the time-study department is to be notified of all new jobs established.

Assuming that a reasonable foundation of routine is laid down somewhat as indicated above, and observers are turned loose in the shop, results are strictly up to the time-study chief. Spurred by the knowledge that what the management wants is expressed in total payroll figures, he must mix brains with experience and a sense of proportion. His first duty must be to strengthen and back up his own staff. This can

best be done by making them work uniformly and consistently. Considering time-study men for their personal efficiency prompts additional and more specific regulations:

9. Put observers on hourly rate and have them work the same hours the factory works.

10. Number studies consecutively and log all studies in a permanent book, one book for each observer.

11. Keep a standing record of each change showing old and new rates.

12. Cut number of observations to a safe minimum and set a minimum life duration for the time study.

13. Cut out waste time in figuring rates to odd cents. Raise the $5.98 per thousand rate to $6.

14. Study high production jobs first.

15. Note element times, but don't slavishly work out each one for every time study.

16. Remember that average time, determined from over-all time plus incentive, gives basis for a fair rate.

17. Reduce computation work by adding the letter *X* in element elapsed-time space where an unnecessary foreign element occurs. If action is foreign but necessary, such as oiling, add the letter *Y*. For rapid over-all computation simply throw out the *X* times.

18. Remember that on this type of work it is not absolutely necessary to throw out high and low times.

19. Cut down number of studies by utilizing existing ones, where possible, to extend rates to other products.

20. Keep organization lines intact by insuring that observers do not palaver with operators about rates.

21. Ruthlessly eliminate any sneaky observer methods such as carrying a concealed watch in a pants pocket.

22. Set a high standard for time studies so that any rate set can be backed up by a time-study record.

23. Inspire observers with a willingness to retime any job seriously questioned by an operator.

In the last analysis, foremen are the ones who must be sold on new wage rates. A useful procedure with hard-to-convince foremen is to ask them, "What would you do if you had to demonstrate to the management how quickly this job could be done?" Most operators can be satisfied by lending them the time-study watch, or by inducing them to use their own watches to time themselves. The observer must exert painstaking effort to explain time studies to operators.

To minimize operator reaction, first rates established should not be too tight. For the same reason, avoid releasing too many new rates in a department at one time. It boosts the time-study department and encourages average operators if men who give extra effort are allowed to make good money. Strangely enough, operators look favorably on piecework rates for such jobs as cleaning machines or sweeping certain departments, and these rates can be made loose enough to serve as good time-study publicity without materially affecting the payroll.

Never Disheartened

The time-study chief relies on experience, but grasps all comparative price data that can be secured. He is not disheartened by seeming discrepancies, for he knows that even conscientious operators vary by as much as 15 per cent in effort, and that a difference in the manner of picking up parts may vary the piecework time 10 per cent.

His serious aim of reducing payroll can be hastened by scrutinizing jobs to see whether lower-priced labor can be used. He will find small jobs of cleaning, counting, sorting, checking, piling, or trucking being done here and there in the plant by highly rated men and charged on daywork. If these jobs are so few as to make employment of unskilled labor uneconomical, the remedy is a blanket regulation that all work of this kind, regardless of who does it, carry a flat rate based on what it is worth to the firm.

If there are old operators whom the management wishes to continue at the old rates, it is advisable to arrange new rates and take care of the old operators in a special payroll account.

In spite of stringent regulations, it will be found that many jobs are pushed through at old rates, or on daywork. Foremen invent innumerable excuses. There is one plan that stops this, however—make a ruling that regardless of what is entered on the time tickets, all jobs done at the old prices, or on daywork, will be paid for at a very low rate. Such a decision should be communicated directly to the operators by the foremen, rather than by posted notices. Clamp on such a regulation, and immediately foremen and operators clamor for time studies.

Questions of speed and feed come up regularly. Drills are run delicately; operators take two roughing cuts on lathes where one would do; milling machines are fed too slowly. Tempering each decision with practical judgment, tell the foremen to "run her till she breaks." Generally, the machine starts to shake before anything serious happens. Anyhow, a new tap costs the firm less than a loose piecework rate.

New tooling considerations provide a troublesome problem. Solve it by feeding cigars to the tool designer until he willingly and promptly gives over-all estimated costs on new tool suggestions. It is then a simple matter to estimate rate reduction savings and compare them with cost of this new equipment.

Definite figures on results secured by an extensive time-study drive are not obtained in a flash. The time-study chief sitting in the weekly conference may know that his carefully built structure of new rates is there beyond doubt, but owing to diversity of production is not immediately reflected in the payroll.

It is part of his job to keep the management sold, and he can do it by pointing out other less obvious ways to judge time-study progress:

1. Show percentage of increase in new piecework in each productive department.

2. Show percentages of piecework in the whole plant. This should increase with the additional rates.

3. Show yearly savings with new piecework rates based on previous year's production figures.

4. Set up total direct-labor cost as a percentage of value of shipments. This percentage should show a monthly decrease.

5. Work out cost of time studies and set it against savings obtained.

Bonus in the Shipping Room Adds 20% to Earnings

A December article described changes made in the Pro-phy-lac-tic shipping room before group bonus was installed. The bonus plan now to be detailed supplies one more proof of the fact that incentives need not halt at shipping room doors

H. B. LEACH
Head of Standards Department
Pro-phy-lac-tic Brush Company
Florence, Mass.

THE GROUP BONUS plan we set up in our shipping room some seven years ago is part of a general bonus plan installed throughout the plant. I have confined myself to the shipping room part of the job because so often the wage incentive enthusiast lets himself be stopped just outside its door.

I described in a previous article how we revamped our shipping room layout prior to installing this bonus plan, and shall now proceed with a description of the plan itself.

First there were these essential operations to be studied:

1. Receiving and storing stock and containers.
2. Assembling containers.
3. Filling orders.
4. Checking and re-checking.
5. Packing and closing cases and cartons.
6. Weighing and stenciling.
7. Recording and billing.
8. Loading.

These eight jobs comprise most of the day's work. Standard times in minutes were then developed for each of the many different shipping containers. Curves such as those shown in Figure 1 were then constructed and are now used whenever new sizes are introduced. Of course it is in the make-up and packing operations that the chief differences lie. Some of the operations—weighing and stenciling, for instance—are constant, or practically constant, regardless of the size of the case.

After the standards were completed, the total for each case was then given a tally number which identifies the size, kind of package, and standard minutes allowed. To measure the day's work, then, the time clerk has only to keep a tally of the day's shipments. This is done on the daily summary sheet illustrated in Figure 2, which also shows any special jobs—in this instance one large, odd-size wooden case on which actual time was allowed—as well as amount of stock put away.

Standard times have also been set on all miscellaneous jobs performed by the group — cleaning, for which 30 minutes are allowed, or monthly inventory, and jobs of like nature.

From this summary the daily payroll record (Figure 3) is then compiled. It shows that nine men, for the sake of illustration, worked a total of 3,915 minutes on the day in question. It shows the number of various cases packed—for example, 6 wood, size 486, Tally No. 51, for which the standard time is 34.51 minutes, making a total of 207.06 minutes for that particular item. The standard minutes (column 9) are taken from a bonus chart (not shown) and are extended by the payroll clerk. Standard times for special jobs, also for putting away toothbrushes in stock, are likewise extended.

It then becomes a simple matter of arithmetic to determine the total standard minutes for the group and to divide the standard minutes (3,402 on the day selected for illustration) by the actual minutes (3,915) worked by the group. In this way group efficiency for the day is found, and in this instance turned out to be 87 per cent.

Bonus is then paid each man in the group for the class of work he is doing on a pro rata basis and at the efficiency attained by the group. For this purpose every job in the shop has been classified. There are seven bonus classes in all which pay bonuses ranging from 25 cents to $1.75 a day for 100 per cent efficiency.

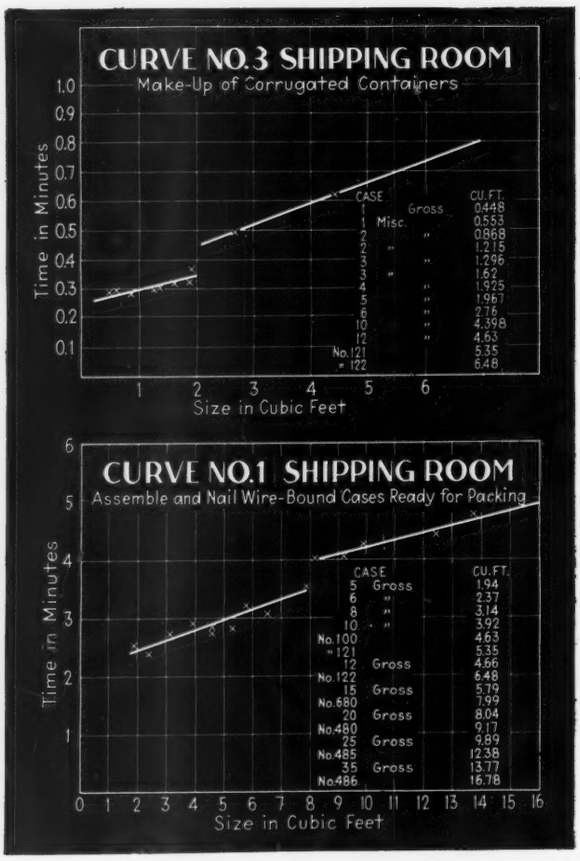


FIGURE 1. Curves like these supply standard times when new sizes are introduced

DAILY SUMMARY OF CASE, PKG. & ETC. SHIPPED

Date 10-13-36

DOMESTIC ONLY					FOREIGN ONLY				
Kind	Size	Tally No.		Total Time	Kind	Size	Tally No.		Total Time
Wire	1	1			Wood	4	41		
	2	2					42		
	3	3				6	43		
	4	4				8	44		
	5	5				10	45		
	6	6				12	46		
	100	7	𝍸 𝍸 II			15	47		
	121	8				20	48		
	122	9				25	49	𝍸 II	
	680	10				35	50		
	480	11	𝍸 IIII			486	51	𝍸 I	
	485	12	𝍸 𝍸 𝍸 IIII		Wire	1	52		
	35	13				2	53		
	485	14	𝍸 𝍸 IIII			3	544		
	Larkin	15			Corr.	1	55		
P.P. Corr.	1	16	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII			1M	56		
	1M	17	𝍸 𝍸 𝍸 𝍸 IIII			2	57		
	2	18	𝍸 𝍸 𝍸 𝍸 IIII			2M	58		
	2M	19	𝍸 𝍸 𝍸 𝍸 𝍸			3	59		
	3	20	𝍸 𝍸 II			3M	60		
	3M	21	𝍸 𝍸 𝍸			4	61		
	4	22	𝍸 𝍸 I			5	62		
	5	23	𝍸 I		Corr. Burlap	4	63		
	6	24	𝍸 IIII			5	64		
Corr.	4	25				6	65		
	5	26	𝍸 III		Corr. Wrap Pkg.		66		
	6	27	𝍸 II		Spc.		81	1 large spc. wood	
	10	28			315		68		
	12	29			7151		71		
	121	30			13248		72		
	122	31	𝍸 𝍸 III		5052				
6 in one		32			3645				
School Teacher		33			14775				
Corr. Wrap Pkg.		34	20-𝍸 I-20-10		18168				
Form 501			Total Pkg.						

FIGURE 2. To measure the day's work, the time clerk has only to keep a tally of shipments, stock put away, and any special jobs that may have been assigned to the group

For example, turning again to Figure 3, we find that seven of the nine men are in Class 4, two in Class 2. Bonus at 100 per cent efficiency is $1 per 8-hour day in Class 4, 50 cents in Class 2. No bonus is paid when efficiency falls below 70 per cent. Bonus for each man according to the actual time he worked is then set down from the bonus chart. For instance, on the day in question the men in Class 4 who worked their full 8 hours got a bonus of 77 cents, whereas one who worked only 7 hours got 67 cents, and so on.

Bonus earnings vary as the requirements change. However, the supervisor can partly control the situation and the amount of the bonus by correctly anticipating the number of men necessary to handle the day's shipments. Without the bonus the tendency would be to operate with 8 or 10 men full time, and when the work was slack he would hesitate to reduce the number of men. Being on bonus himself, however, he is careful to make such adjustments as are necessary to bring up the efficiency of the work. For instance, on the day noted he loaned one man to another department at 3:30, another at 3:45, thereby cutting 105 minutes from the total actual time worked and adding a few points to the group's efficiency. More important still, he was able to keep the time of direct labor for his department at the lowest possible figure.

Obviously, then, the group bonus plan in our shipping room benefits both the company and the men. The company gets better results, hence lower unit costs. The men can make 20 to 25 per cent more money. These, it seems to me, are the fundamental objectives of any manufacturing enterprise.

FIGURE 3. Payroll record is compiled from daily summary of work completed, standard minutes being taken from a bonus chart not shown here

DAILY PAYROLL RECORD

Pro-phy-lac-tic Brush Co. BONUS CHART 180

Sheets-Sheet No. 1 Shop Clerk L. J. F. Dept. 5 Date 10-13-36

Man No.	Time			Tally No.	No. Good Pcs.	Std. Time per Pc.	Std. Min.	% Eff.	Bonus Class	Bonus
	Start	Stop	Worked							
1	2	3	4	5	6	7	8	9	10	11
183	7 30	4 30	480	7	12	10.05	120.60	87	4	.77
185	7 30	4 30	480	11	9	13.17	118.53		4	.77
186	7 30	4 30	480	12	19	14.84	281.96		2	.39
187	7 30	4 30	420	14	14	17.21	240.94		4	.67
188	7 30	4 30	480	26	8	3.72	29.76		4	.77
189	7 30	4 30	480	27	7	4.13	28.91		4	.72
190	7 30	4 30	480	31	13	5.91	76.83		4	.77
192	1 30	4 30	180	49	7	28.05	196.35		2	.14
161	7 30	3 45	435	51	6	34.51	207.06		4	.69
			3915	16	34	3.39	115.26			5.74
				17	24	3.42	82.08			
				18	24	3.55	85.20			
				19	25	3.70	92.50			
				20	12	3.74	44.88			
				21	15	3.88	58.20			
				22	11	3.98	43.78			
				23	6	4.00	24.00			
				24	9	4.48	40.32			
				34	56	2.48	159.04			
				68	312	3.	936.00			
				71	7151	.014	100.11			
				72	13248	.0006	7.95			
				73	5052	.0005	2.53			
				75	3645	.014	51.03			
				76	14775	.0006	8.87			
				77	18168	.0005	9.08			
				81	* 1	150.00	150.00			
				82	1	60.	60.00			
				71	1	30.	30.00			
							3402.00			

Std. Minutes 3402 = 87%
Act. Minutes 3915

* Large wooden case-made in carpenter shop and spc. packing OK J.J.F.

Checked by

Comptometer by D TOTALS

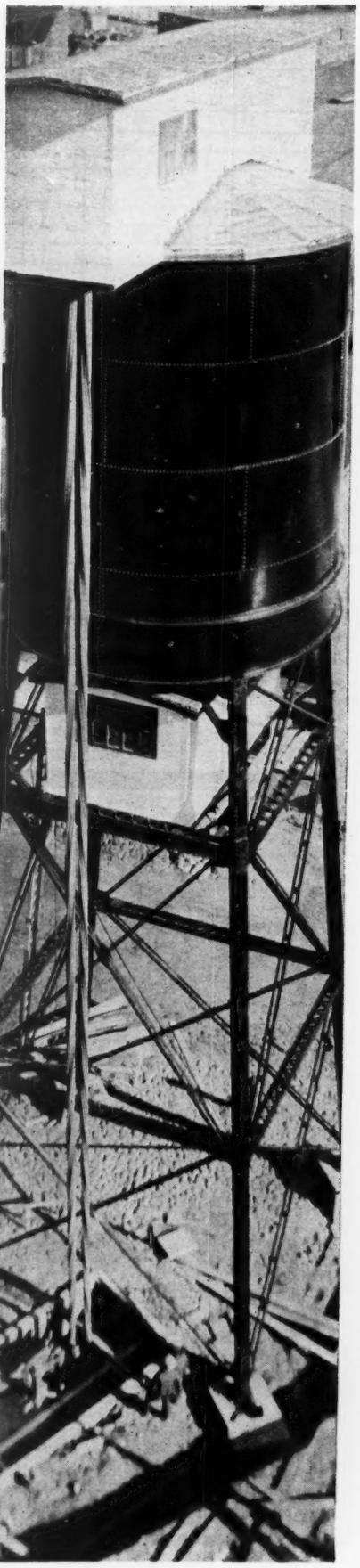
The Pipe Line That Travels

To convey bulk materials, it's swift and noiseless, goes wherever you want it to go, makes no dust, costs little to operate and maintain

THINK of the ordinary pipe line that runs from point to point, and so can be made to convey bulk materials in any direction. Picture then, if you can, a rubber pipe line that can be set in motion, filled with solids or liquids, and made to convey them either horizontally or vertically or both to one or more predetermined discharge points. If your imagination has not quit cold long before this, then you have a rough picture in your mind's eye of the Johns conveyor, the newest development in the materials handling field and, because of its wide applicability, one of the most important in recent years.

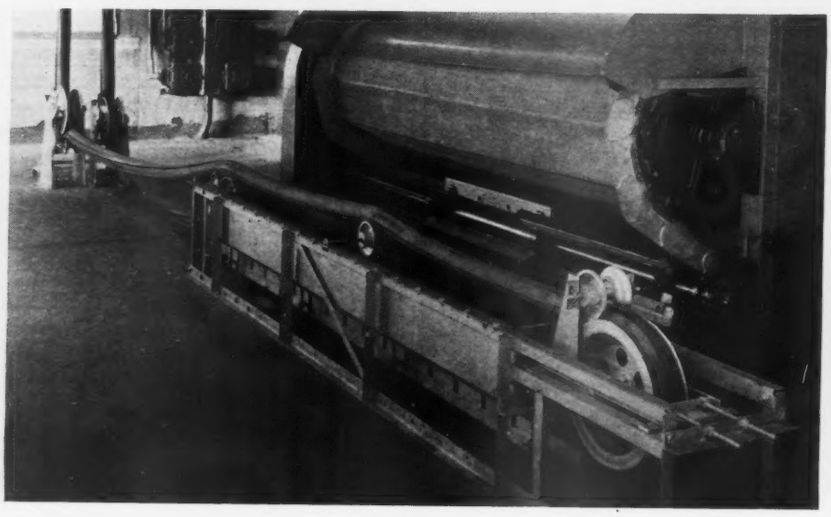
You may now complete this vague picture by turning to the accompanying photographs, which illustrate three typical installations. One handles crushed lime at a gold mine; another, a fine, powdery material in a chemical plant; the third, coal in an industrial power plant.

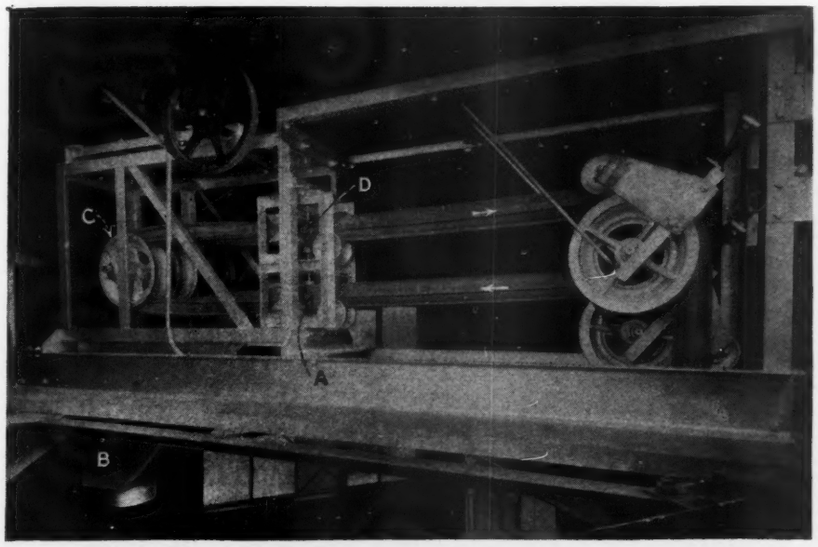
From these pictures it will be seen that the traveling pipe line is made

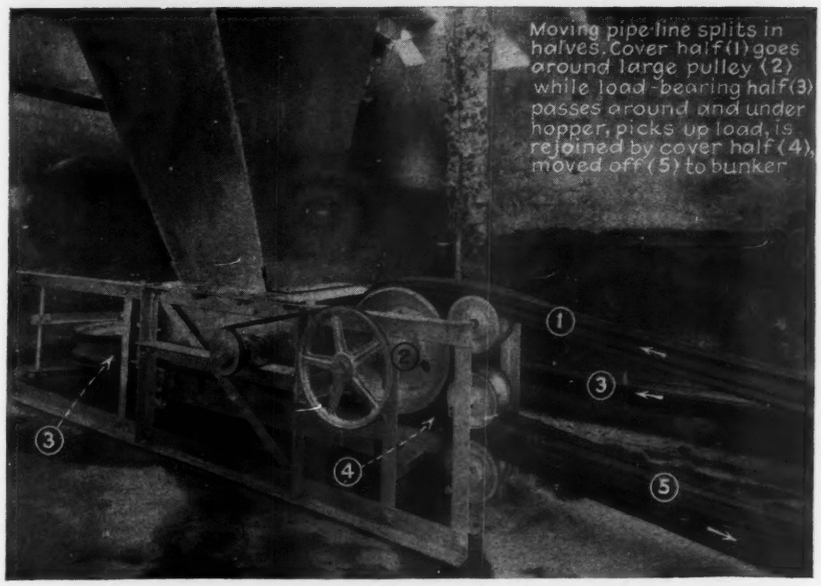


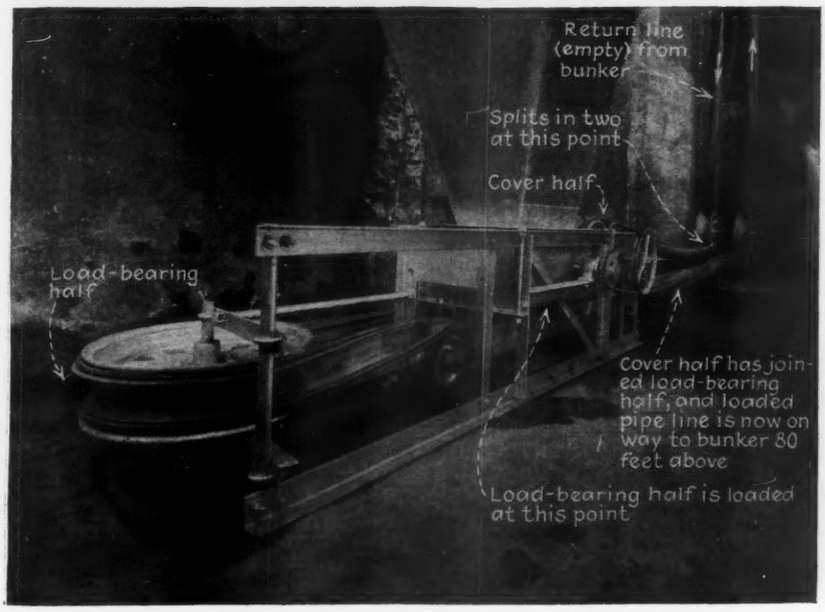
Moving pipe line conveyor (right) at Canadian gold mine lifts crushed lime 87 feet. Size, 4 inches in diameter. Capacity, 120 tons per hour at conveyor speed of 500 feet per minute. Driven by a 7½-hp. motor, average requirement is 5.65 horsepower. No heavy starting torque

Pipe line conveyor (below) installed by a New Jersey chemical concern, is 2 inches in diameter, has a capacity of 30 tons per hour at 500 feet per minute. Material from tunnel drier is picked up in the hopper by pipe line which moves it horizontally 12 feet, vertically 16 feet, then horizontally 30 feet to any one of three discharge points over a 20-ft. storage bin






Moving pipe line splits in halves. Cover half (1) goes around large pulley (2) while load-bearing half (3) passes around and under hopper, picks up load, is rejoined by cover half (4), moved off (5) to bunker
1
2
3
3
4
5


Return line (empty) from bunker
Splits in two at this point
Cover half
Load-bearing half
Cover half has joined load-bearing half, and loaded pipe line is now on way to bunker 80 feet above
Load-bearing half is loaded at this point

up of two rubber belts, each reinforced by a heavy chain imbedded in the rubber. These halves fit together by means of double tongue and grooves which prevent the material being carried from sifting or leaking out. One of the halves is fitted with disk-like partitions or flights which serve to pick up a full load as the load-bearing half passes through a hopper, and which also form individual compartments to prevent slipping and packing of the material on vertical lifts. When conveying liquid or wet materials, these partitions prevent the formation of a hydrostatic head.

When the halves are fitted together to make a whole tube, the tube is twisted in order to form a tight seal and prevent the tube from opening. This twist is imparted when the conveyor is originally threaded through the pulleys.

Flexibility is perhaps the outstanding advantage of this conveyor. Easy to install, it can be lengthened or shortened at will. Direction can be changed very simply. It can be set up permanently or temporarily. Power requirements are small — 3 to 3½ horsepower in the installation pictured on this page.

Important to note is the fact that this conveyor moves materials without rubbing or tumbling, hence without breakage or dust. It handles wet materials like concrete mixes or mortar. It takes sticky materials in its stride. When dry materials are being handled, a few twirls while empty are enough to clean it. Or if materials are sticky, the two halves can be washed and dried by running through suitable baths and ovens.

•

Left, three views of coal handling installation at Manhattan Rubber Company's Whippany, N. J., plant. Car of rice coal is spotted over hopper; moving pipe line lifts coal 80 feet to bunkers, unloads car in 4½ to 5 hours

Bottom photograph shows what goes on in pit under car. Note load-bearing half with disk-like partitions which serve to pick up full load when passing through hopper

Middle, another view of same installation, showing how two halves separate, then come together after load-bearing half has come through hopper. Note twist. It is put in when pipe line is originally threaded through pulleys. Purpose, to compress halves, make a tighter seal, keep tube from opening

Top, view in bunker, 80 feet up. Here loaded pipe line splits in two at *A*, discharges coal into hopper *B*, passes around pulley *C*, with halves coming together again at *D*

This Plant's Not Modern But Its Layout Is

D. C. KICKLER
Consulting Engineer
Farmville, Va.

MANUFACTURERS in years gone by could sit quietly at their desks with few worries to plague them. Their markets would take whatever products they turned out, usually at the prices asked. Times have changed, however, and tightening markets with keener competition have placed a premium on price. To manufacture and sell at the lowest possible price has become the aim of all. Strict cost control has become the order of the day.

Low Unit Cost Imperative

To this end, manufacturers must look to plant layout, materials handling, and production and inventory control as never before. Low-cost production is imperative, and as means to its accomplishment accurate records of costs must be kept, tight control exercised.

In one plant manufacturing cabinets, tables, telephone stands, and various novelties made from wood, considerable attention has been given to plant layout. In my opinion the results justify passing the information along to other manufacturers. The figure shows how material is routed from the storage yard through the processing operations to the loading platform. From the yard, it is moved first to the dry kilns, then to dry storage. From there it is taken by lift truck to the surfacer whose operator, after he has finished his part of the job, piles it within easy reach of the cutoff saw. It is moved to the ripsaw next; then on to the various machines so arranged that there is the least backtracking possible.

After all operations in the mill room have been performed, parts go to the cabinet room, across the runway to the finishing room, then to trimming and packing, and on to storage or the loading platform.

All departments in the plant are designated by letters. The lumber yard, the first department, is known as department *A*. The work of receiving and storing the lumber and operating dry kilns is overseen by a foreman. All lumber unloaded from cars and trucks is piled in bulk until inspected and either accepted or rejected by the company. The lumber companies are held strictly to specifications, and they must take back any below-grade stock unless the company agrees to take it at a fraction of its price. Strict inspection makes for high-quality production and reduced waste.

When lumber is piled for air drying, about one-half the stock usually kept on hand is piled on dry kiln trucks to save an extra handling. Yard piles and kiln truck piles are placed in rows, the rows being lettered in alphabetical order. Lumber is piled about 14 inches off the ground in front and 6 inches in the rear. Different lengths are piled separately, and stuck every 2 feet with piling strips $1\frac{1}{2}$ inches square to allow plenty of ventilation.

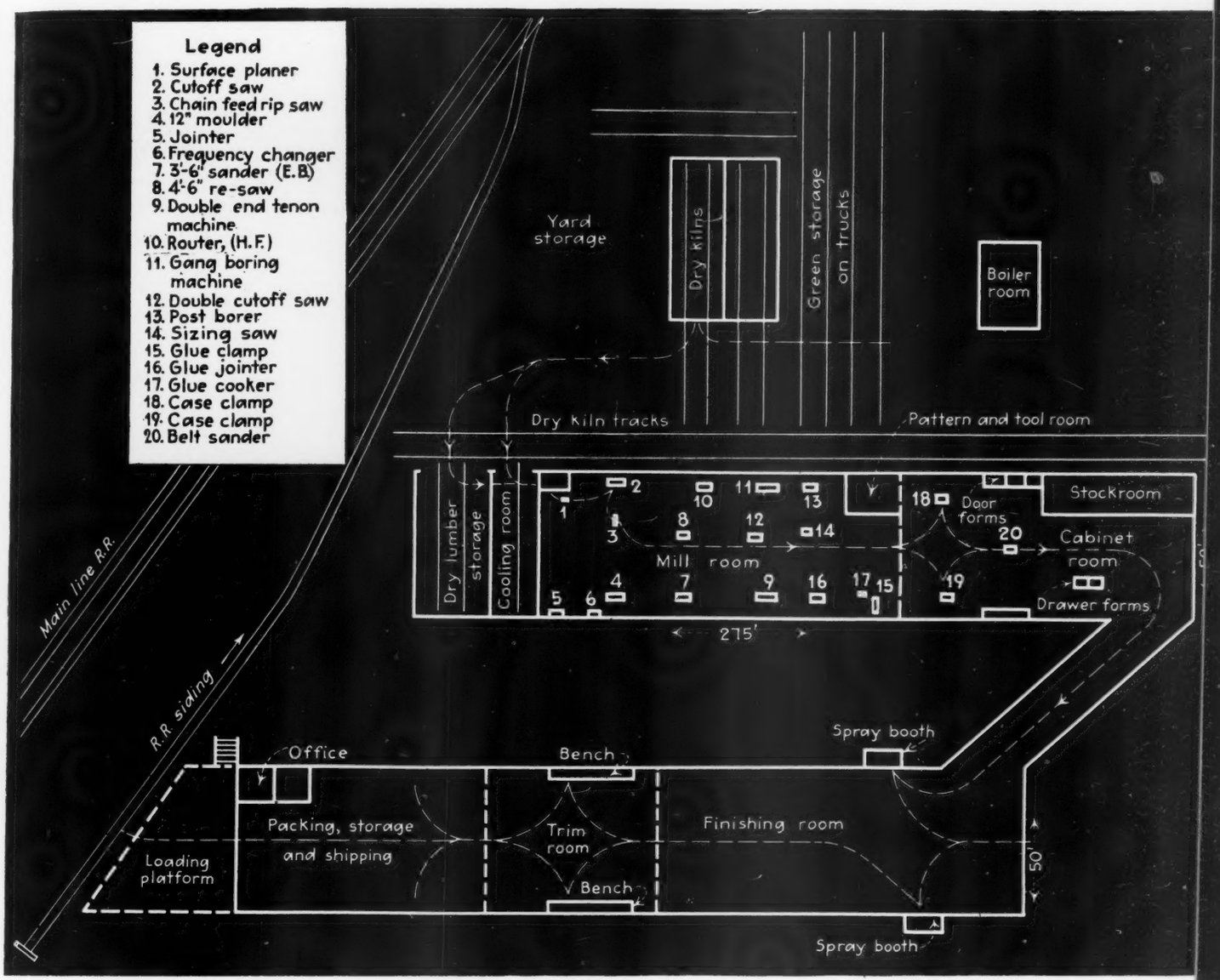
With the pile well off the ground and at a good pitch from front to rear, and well covered on top, there is an unbelievable saving over careless drying methods. Yard seasoning really ruins more lumber than dry-kilning, if not properly handled. This particular company claims practically no loss in air drying, however, and at least a 10 per cent saving over the old method of piling where piling strips of any thickness were used, and different lumber lengths were not separated.

Each yard pile and truck pile is numbered according to the day, month, and year piled. For instance, lumber piled in row *A* on February 5, 1936, would be designated *A*256. From this number it is an easy matter to tell at any future time just how many months the lumber has been drying.

The foreman keeps a record of all lumber received, on hand, and sent to the factory. For the dry kilns he keeps the same kind of record. His records are in reality a perpetual inventory.

Next department is the mill room, known as department *B*. The figure shows the machine layout here. Although the surfacer and cutoff saw are located in this department,

Moral of this article: When plant is old and worn-out, keep on remembering that a brand-new plant will be more economical in the long run. But if for one reason or another the new plant is not immediately forthcoming, don't let antiquity cramp your style. Don't let anything stop you from laying out the plant you have for lowest possible production costs



Remember, this is not a thoroughly modern plant. No doubt the men who operate it clamor for new buildings the same as you do. It is obvious, however, from the way materials are routed out of storage through process to the loading platform, that they have not allowed the lack of modern plant facilities to stop them from doing a thoroughly modern job of production planning

all the labor used on these machines and waste materials resulting from them are charged to the lumber yard, making the mill room production start with the chain-feed ripsaw.

A Check on Tools

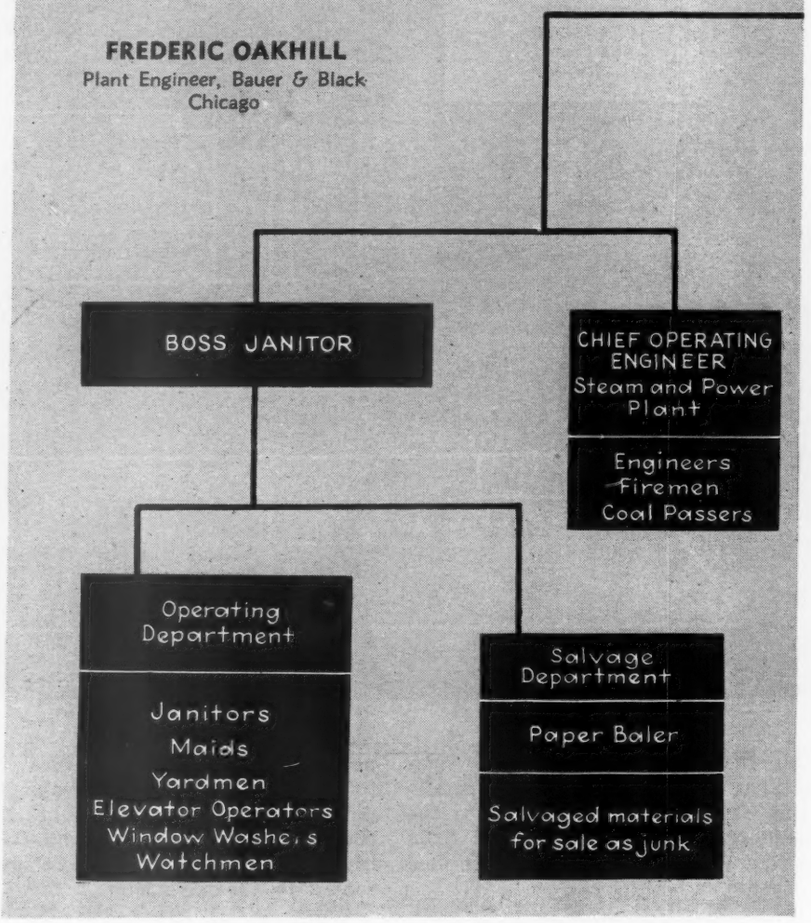
A pattern is provided for every job, to which is attached a tag showing the name and number and a rough sketch showing size and length of cuts to be made. The machine operator receives his pattern and any necessary tools from the pattern and tool room. He is provided with a ring of ten numbered brass checks, and for each pattern or tool drawn, he must surrender a check which is hung upon the hook from which the pattern or tool was taken. By this record employees can be held responsible for patterns or tools; when leaving the company's employ they must return all ten checks to their foreman who then gives a clearance slip to be presented to the paymaster.

When all is said and done, it must be remembered that this is not a thoroughly modern plant. It was built as cheaply as possible—one-story, mill-type construction, storm-sheathed, with corrugated galvanized iron sides and roofing. Both new and used machinery are in operation, practically all motor-driven. Power is bought outside, and the boiler room is used only to burn sawdust and shavings, run the dry kiln, and furnish heat for the plant. Others having the same problems this plant faced need not think they necessarily suffer a competitive disadvantage because their buildings are not up to the minute. Admitted that new buildings would be better, still present buildings will do if new ones can't be had. The way the job is done inside can make a very big difference.

(A second article, scheduled for early publication, will discuss production control methods employed successfully in this same furniture plant—ED.*)*

See Your Maintenance As It Looks on Paper

FREDERIC OAKHILL
Plant Engineer, Bauer & Black
Chicago



I. Purpose of Procedure

THE PURPOSE of this procedure is to define the organization and responsibilities of those groups which make up the Plant Department.

II. Of Concern to

The entire plant personnel.

III. Forms Used

Organization chart of Plant Department.

IV. Statement of Organization

The Plant Department is composed of the following groups:

1. Engineering Department
2. Mechanical Department
   - Electrical Crew
   - Steamfitters
   - Machinists
   - Carpenters and Millwrights
   - Painters
3. Steam and Power Plant Departments
4. Operating Department
   - Janitors
   - Maids
   - Yardmen
   - Elevator Operators
   - Window Washers
   - Watchmen
5. Salvage Department

V. Statement of Responsibilities

The responsibilities of the Plant Department shall be to supervise and maintain the company's physical properties and equipment at greatest efficiency of operation with the least possible expense. Also, the department shall be responsible for the design, construction, and installation of all engineering work pertaining to buildings and equipment including any and all changes thereto.

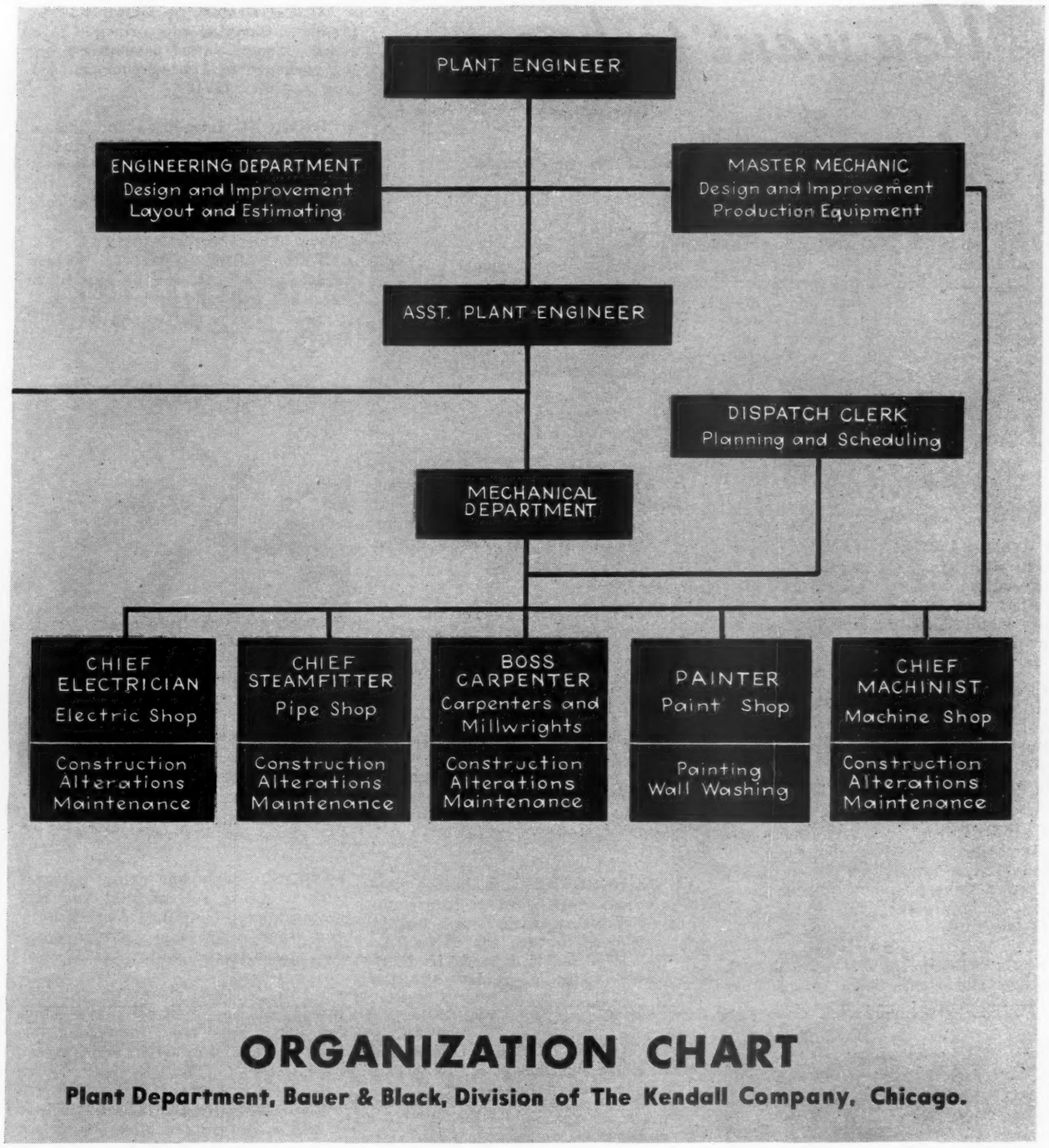
The Plant Engineer shall be fully responsible for the activities of the Plant Department.

1. The Engineering Department shall lay out, design, and estimate the cost of all engineering work and alterations.

The work shall be supervised and executed by the Plant Engineer, with the assistance of the Master Mechanic, Assistant Plant Engineer, Chief Electrician, Chief Steam Fitter, Chief Machinist, Boss Carpenter, and Painter. These men shall individually or collectively, whichever is most advantageous, do the engineering and estimating work required to complete the problem under consideration.

The Master Mechanic shall be in charge of the design and improvement of all mechanical production equipment.

2. The Mechanical Department



ORGANIZATION CHART

Plant Department, Bauer & Black, Division of The Kendall Company, Chicago.

shall be responsible for the construction, alterations, installation, maintenance, and scheduled inspection of a mechanical nature of the company's buildings and equipment.

The Mechanical Department in conjunction with the Purchasing Department shall be responsible for the securing of services, materials, and supplies of a mechanical nature for any and all other departments.

3. The Steam and Power Plant Departments, supervised by the Chief Operating Engineer, shall be responsible for the continued and economical operation of the following equipment:

Steam generating equipment and auxiliaries

Steam-driven fire pump and its storage cistern

Ball engine and generator including balancer-set

Heating system vacuum pumps

Ice machines

Corliss engine

Air compressors in engine room

House water supply tank pumps in boiler room

4. The Operating Department, supervised by the Boss Janitor, shall be responsible for the plant janitor service, elevator operation, and watch service.

5. The Salvage Department supervised by the Boss Janitor shall be responsible for the reclaiming of all waste materials salvaged for sale as junk.

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• FOR LAYOUT and drafting work a stainless steel combination tool, vest-pocket size, is drill-point gage, center-head, and bevel protractor all in one. With it concentric parallel lines, squares, angles can be inscribed and holes and bearings can be checked for center location. On the back is a tap drill table. (1701)

• MINIMUM WAGE legislation in the United States — a selected bibliography of material published as fact or opinion. (1702)

• WOOD-SAWING MANUAL contains such handy information as characteristics, tensile strength, and suggested uses of various woods. Tells how to joint, file, and set hand, circular, and band saws. (1703)

• PARTS molded from a new plastic are said to have three times the shock resistance of standard plastic pieces. Molded parts can be machined and sanded, then buffed back to normal lustre. (1704)

• BINDERS to hold regulations and pamphlets of the National Fire Protection Association are now available. They will keep your copies in good shape and prevent your losing them. (1705)

• RUSTPROOFING MATERIAL cleans and etches metal preparatory to painting. It takes off grease, oil, wax, and surface oxidation, dries in 10 minutes. (1706)

DESK HIGH, this storage cabinet is a handy thing to have any place in the plant or office. Made of furniture steel, it has two adjustable shelves and steel pocket on back of door, precious storage space for all odds and ends (1725)

• YOU MAY GET some ideas of how you can use zinc die castings to your profit from a profusely illustrated booklet showing variety of products made. Appearance and intricacy of some items will impress you. (1707)

• HEAT GUN and hand vacuum cleaner, electric, are combined in one unit. Heater unit, suited to thawing operations, attaches to exhaust orifice of cleaner. (1708)

• HANDBOOK on flow meter engineering gives a quantity of information on steam, liquid, and gas flow measurements, and orifice design. Illustrations, tables, charts. (1709)

• NON-DUSTING concrete floors can be had by applying a hardener which fills the pores and keeps oil, grease, and other staining materials from entering the finish. It's applied with a long-handled brush. (1710)

• FIRE-HOSE REEL makes it possible to turn on the water before unreeling the hose, saves times lost in running back to turn the valve. To prevent bursting, it expands in diameter and width as water fills the hose. (1711)

• PHOTOELECTRIC CELL, self-generating, has sufficient power to operate directly connected relays. (1712)

• LEDGER SAFE has revolving, sliding tray which can be positioned to operator's convenience. Safe gives two-hour protection to records. (1713)

• PLASTIC COVERING, one-eighth of an inch thick, is being molded into zinc castings on a production basis in manufacture of refrigerator door handles. (1714)

• NEW WRINKLE in wrapping is coating applied by spraying, dipping, or painting products too difficult to wrap. Said to be transparent, moisture-proof, and airtight. (1715)

• PACKAGE must be appropriate to product. Carrying this principle to a clever extreme, salted peanuts are being packaged in a 4-inch-long, molded wax peanut. (1716)

• CHEMICAL introduced into steam system is said to arrest carbon dioxide and neutralize carbonic acid throughout the system. It volatilizes with the steam, returns to boiler with the condensate. (1717)

• REFRACTORY PAINT, which hardens with heat, can be applied to steel, cast iron, and firebrick. Is said to retain its properties up to 3,000 degrees F. (1718)

YOU can hardly tell the difference between this zinc-die-casting micrometer and a hand-tooled mike. It can be produced in volume, therefore has low selling price. It's claimed to have perfection of the hand-tooled variety (1724)

• CLEAN greasy and grimy surfaces with a grease solvent that you mix with kerosene. Applied by brush or gun, it produces soapy mixture which cold water washes away. (1719)

• HANDY TOOL cleans up damaged threads on any diameter. It's hand-operated, has two interchangeable hardened heads, comes in eight thread pitches 8-24. (1720)

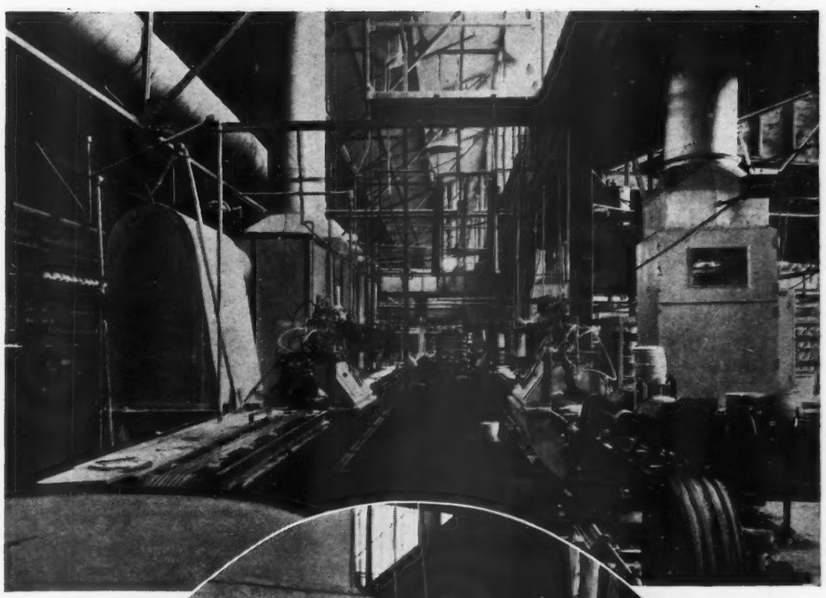
• PRODUCTION CONTROL machine prints on pre-printed piece-pay tickets payroll and cost information about the article to which ticket is to be attached. (1721)

• CONTAINER, waterproof and flexible, has variety of uses. It has zipper fastener, can be washed, scoured, or boiled. Suggested uses range from sample kit to dehydration-preventer for food in refrigerators. (1722)

• WINDOWSHIELD WIPER with rock salt compound bars in the cloth pocket forming the wiping surface should be an aid to driving this winter. The salt melts the sleet and snow. (1723)

If Dust Is Your Problem

This improved electrostatic method of cleaning air may be exactly what you are looking for—whether your primary motive be the protection of processes, products, and men, or the recovery of valuable materials



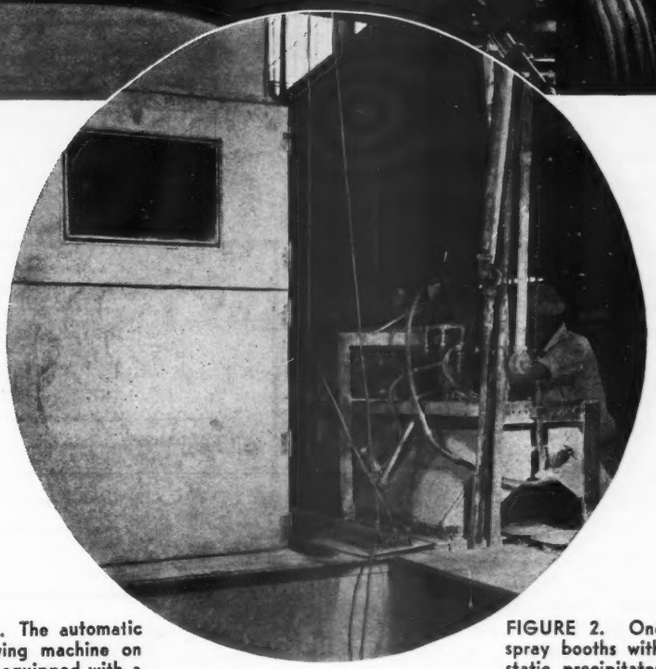


FIGURE 1. The automatic glaze-spraying machine on the left is equipped with a conventional settling chamber; the one on the right uses an electrostatic unit

FIGURE 2. One of the spray booths with electrostatic precipitator for salvaging glazing material

PRECIPITATION of dust particles as fine as ½ micron with a 98 per cent operating efficiency has recently been accomplished in several industrial plants by an electrostatic method lately developed by the Westinghouse Electric & Manufacturing Company.

Particles of dust vary widely in size. Some are large; others are extremely small. A particle ½ micron in diameter measures about 0.000,007,63 in., say, one-thousandth of the diameter of a human hair.

In general, great emphasis is placed on cleanliness in factories, and the need for proper instruction of employees engaged in all operations that create dust. Floors, aisles, walls, and beams are kept clean. Floors are moistened when sweeping. Men engaged in dusty operations are often required to wear masks or other protective devices. Dust-producing equipment is fitted with inclosures where practicable, which are connected to a suction system that exhausts the dusty air. The exhausted air is often cleaned with cyclones or bag filters, and liberated out of doors where the fine dusts are carried away.

When Dust Means Dollars

However, it is not always an easy matter to remove particles from the air. Aside from the fact that they are hazardous from the health standpoint, they may interfere with production processes or, particularly if they are abrasive in character, cause high maintenance costs on equipment. Again the value of certain dusts is high enough to justify their collection.

For example, a West Virginia pottery recently installed ten precipitating units on their automatic, glaze-spraying machines to recover valuable material. Each machine has two spray booths containing eight nozzles each, which spray a total of 8 gal. of material a minute on the ware. Air containing the excess glaze in suspension is exhausted from the booth through the precipitator, Figure 1, which is self-contained and requires only 75 watts to operate it. Each precipitator collects 800 lb. of glaze, varying in value from 6 cents to $2 a pound, in a 40-hr. week.

The new units release 300 sq.ft.

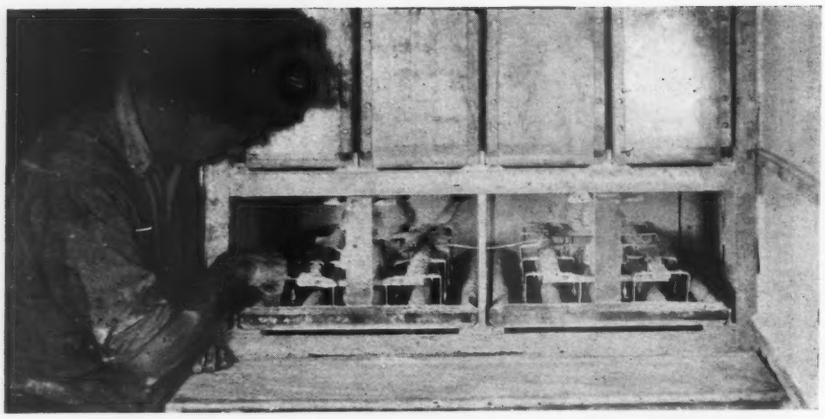


FIGURE 3. Since most of the precipitated glaze falls back into the recirculating system, it is necessary to remove the small quantity of material on the plates only once a day

of floor space, formerly required by the settling chamber, which in addition required 8 hr. to clean, as compared with 30 min. for the electrostatic process.

The glaze material is deposited on plates, Figure 3, where it accumulates until it falls in large pieces to the bottom of the booth. At the end of a working day the glaze remaining on the plates, and that piled in the spray booth, is washed out with water and returned to the supply tanks for use on the next run. An old and a new automatic glaze-spraying machine are shown side by side in Figure 1. The one on the left is equipped with a settling chamber, whereas the one on the right uses the electrostatic air cleaner.

Indicative of the diversity of industrial uses, other applications have been made for the cleaning of air supplied to automatic telephone exchanges, and for filtering the gas flowing to carbon dioxide machines in order to avoid the necessity of frequent cleaning of valves and compressor parts.

Charged, Then Precipitated

These precipitation units are divided into two parts, the ionizing chamber and the precipitation chamber. The relative arrangement of these parts is shown in Figures 4 and 5. A moderately high direct-current voltage (12,000 to 15,000 volts) is supplied to the fine wires marked *A* in Figure 4. This voltage produces large numbers of ions which flow between these wires and the grounded cylinders *B*. The plates shown by dotted lines are connected to a d.c. source which is of approximately half the voltage applied to the ionizing wires, but which produces a uniform electrostatic field of relatively high intensity between the plates, when those plates shown as solid lines are connected to ground.

Particles in the air passing through the ionizing chamber are charged. Upon entering the precipitating chamber the electrostatic field between the plates exerts a force which drives the particles to the grounded plates where they are deposited. At necessary intervals these plates are cleaned by washing with water.

Since the field intensity is high and the distance between the plates through which the charged particles must pass is only $\frac{1}{4}$ to $\frac{1}{2}$ in., the precipitating unit can be made compact and of comparatively small size. The low voltage and low power requirements permit the use of ordinary electronic tubes.

The electrostatic units have a low air pressure drop and the air may be passed through at relatively high temperatures. It is said that the discharged air does not contain appreciable amounts of ozone or oxides of nitrogen, and may be breathed without irritation of the nose and throat membranes.

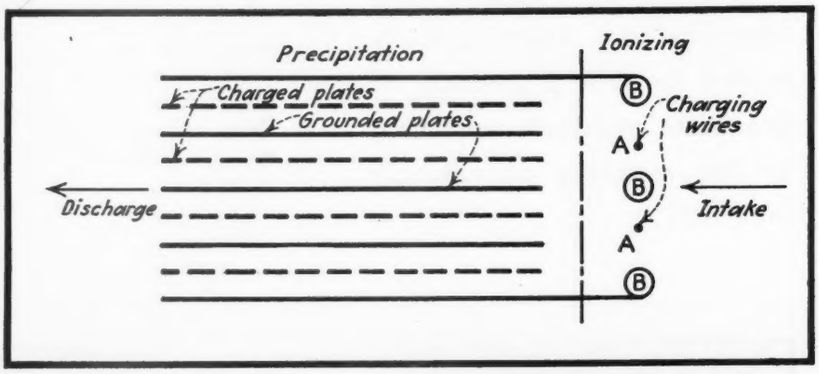


FIGURE 4. How the ionizing and precipitation chambers are arranged. A d.c. voltage of 12,000-15,000 volts is impressed on the fine wires *A*. About half that voltage, also d.c., is put on plates shown by dotted lines and creates a strong field between these plates and others represented by solid lines, which are connected to ground. Dust particles are charged by the high voltage on the fine wires and are then driven to the grounded plates by the field existing between the two sets of plates

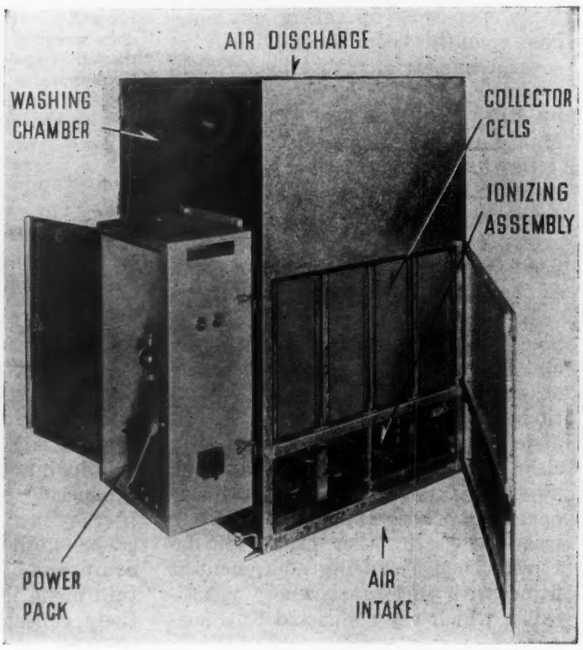


FIGURE 5. A precipitating unit consists of several elements. This one is rated 2,400 c.f.m. and is approximately 56 in. high, 50 in. wide, and 38 in. deep

They Put Group Drives Under the Floor

G. A. VAN BRUNT
Associate Editor

WHEN the new knitting plant of Tubize Chatillon Corporation at Hopewell, Va., was designed, the management wanted to eliminate certain disadvantages of overhead belts, and at the same time retain the good points of group drive. These objectives were achieved by installing the lineshaft and motors in trenches cast in the concrete floor, and driving up to the machines. Such an arrangement offers a number of worth-while advantages, and has been highly satisfactory in operation in this plant.

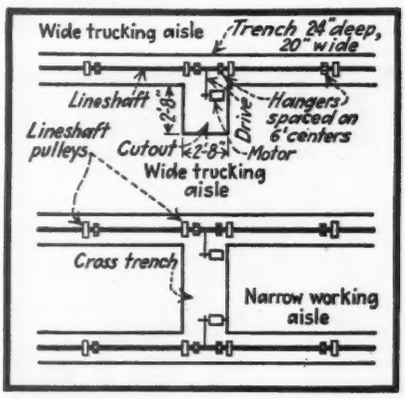
Trouble caused by static electricity was one of the important reasons for desiring to get rid of overhead belts. With ceiling-mounted lineshafts the machine belts were close to the yarn. When a machine was stopped, even momentarily, the static charge attracted and drew the yarn along with the belt, so that frequently the yarn became wrapped around the lineshaft. Several different types of static eliminators were tried, but after extensive tests none was found to be satisfactory from every standpoint. With the new drive layout, trouble from static has been entirely eliminated.

The knitting plant is housed in a one-story monitor-type building of brick and steel construction. The floors are concrete. Twelve trenches, 24 in. deep and 20 in. wide, running practically the length of the building, were cast in the floor. At three places each trench was enlarged to a dimension of 32 x 32 in., to give room for the motors and the chain drive between motors and lineshaft. The general layout of the trenches is shown in the diagram.

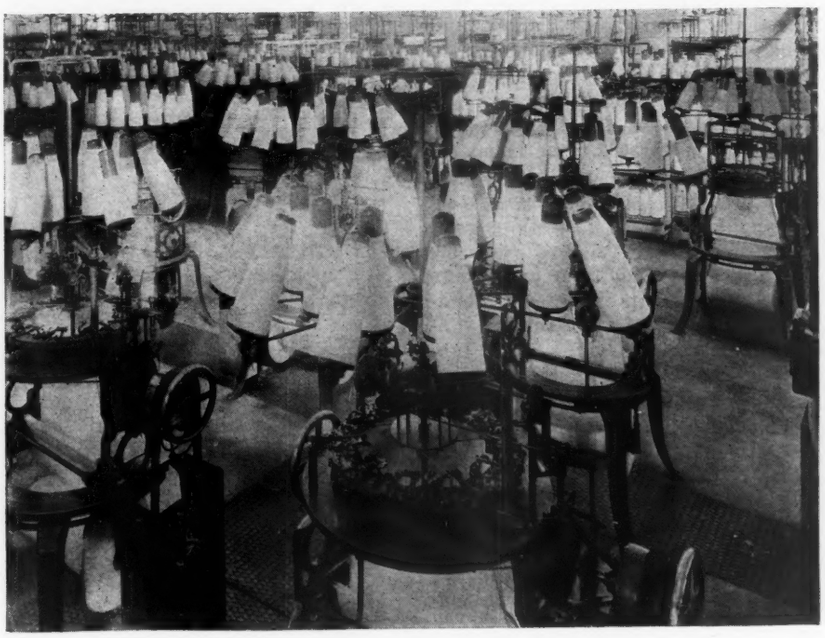
Trenches Are Grouped in Threes

It will be seen that the trenches are in effect grouped in sets of three, two being located fairly close together and connected by a crosscut in which the motors are mounted, while the third trench is placed some distance away. This arrangement, which was used throughout the plant, made it possible to set two rows of knitting machines back-to-back, with only a working aisle between them. Placing the third trench and row of machines farther away provided a wide trucking aisle on both sides of this line of machines. This arrangement is considered the most desirable from the standpoint of efficiency of operation and conservation of floor space.

Three lineshafts ranging from 42 to 46 ft. in length are installed end-to-end in each trench, making

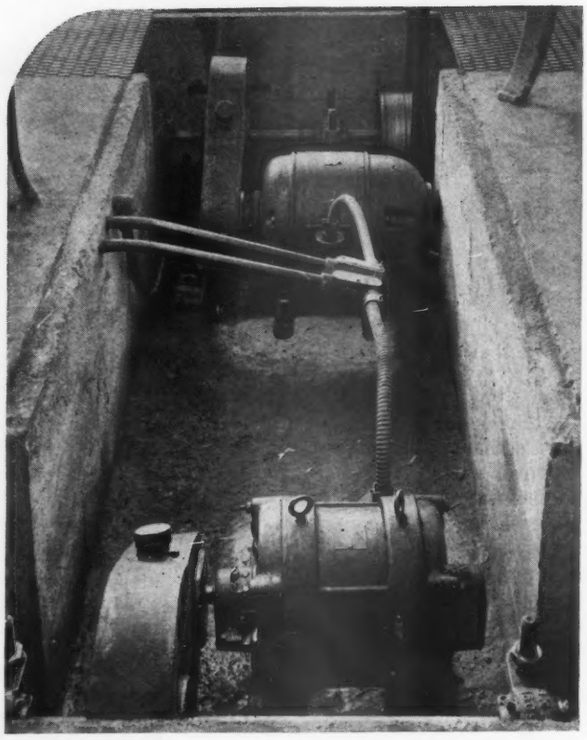


Trenches for lineshafts were laid out to give maximum efficiency of operation and effective utilization of floor space. There are twelve trenches, each containing three lineshafts

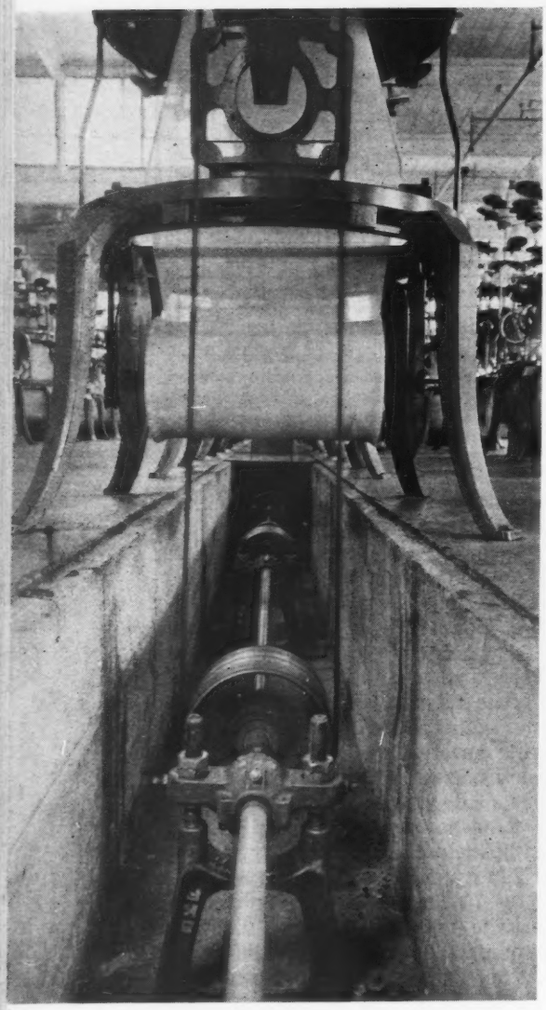


a total of 36 lineshafts. Shafts driving the lighter machines are $1\frac{7}{16}$ in. in diameter; those driving larger machines are $1\frac{11}{16}$. All lineshafts are driven at 245 r.p.m. They are mounted in ball-bearing hangers which are fastened down with bolts anchored in the concrete floor of the trench. Hangers are spaced on 6-ft. centers, except at the point of connection with the motors. At these places a hanger is placed on each side of the chain sprocket.

Lineshaft motors are of the totally inclosed, fan-cooled type. Rated 1,200 r.p.m., they range in size from 5 to $7\frac{1}{2}$ hp., depending on the size of the machine driven. They are mounted on standard rails in the cutout portions of the trenches at about the center of each lineshaft.



Driving motors for two lineshafts are installed in each of the cross-trenches. The motor in the foreground is a spare, used while the other was being repaired



Knitting machines are mounted directly over the trenches and are driven through short vertical belts. Trenches are covered with steel plates

Power is transmitted between motors and lineshafts through silent chain drives using 17-tooth sprockets on the motor shaft and 84-tooth sprockets on the lineshaft.

Eight or nine knitting machines are driven from each line shaft, being mounted directly over the trenches, which are covered with steel floor plates.

Flat Belts on Short Centers

Flat leather belts are used on all machine drives. Their center distances are comparatively short, and it has not been found necessary to use any means of maintaining the proper belt tension. However, a continuous watch for slackness or defects is kept by the machine operators, and when any are reported to the millwrights they are immediately remedied.

Lineshaft pulleys are of the crowned, split-steel type and range from 5 to 12 in. in diameter, depending on the size of the knitting machine and the product. Some fabrics are knitted at a slower speed than is used for others. On one type of machine, 8-in. diameter, 2-in. face, tight-and-loose pulleys are used. Other machines are equipped with 8-in. diameter, 3-in. face single pulleys, a clutch being provided for idling.

The millwrights carefully inspect all belts every two weeks for tension, presence of grease or oil, loose lacings, and so on. Motors and chain drives are examined and lubricated once a month. Particular attention is paid to the condition of the sprockets and the condition and amount of oil in the oil-retaining casings that inclose the chain. All hanger bearings are inspected and greased every three months.

Placing the lineshafts in trenches, below the floor level, has afforded several important advantages. In addition to the elimination of trouble from static charges, belting costs have been reduced by reason of the short center distances between lineshafts and machine shafts. Less than one-half of the footage of belting formerly required for a complete installation is now used.

When lineshafts were overhead, oil drip from hangers occasionally caused spots on the finished product. This source of spoilage has been entirely removed.

Absence of overhead belting has had an important and beneficial influence on the lighting conditions for night operation of the plant. In fact, it was found possible and advantageous to change from local lighting of each machine by individual units to a system of general illumination provided by mercury vapor lamps.

Less Maintenance, More Accessibility

Not the least of the advantages afforded by the new power drive layout is considerably reduced maintenance on the lineshafts and the much greater accessibility. To get at the hangers for inspection or lubrication it is now merely necessary to lift up the belt guard and the trench cover to which it is welded. Hangers are placed close to the machine pulleys and can be inspected with a minimum of time and effort.

▼ ▼ ▼

EMERGENCY STARTERS

Once in a while a starter goes out of business, but you still have to keep a big motor running. What to do? A coming article suggests some of the answers

▲ ▲ ▲

It's Safer if Grounded

A foreman investigating trouble and a workman stealing a smoke would be alive if equipment had been properly grounded

★

ARTHUR F. EDWARDS
Chief Electrician
Chairman Safety Committee
Canada Packers, Limited

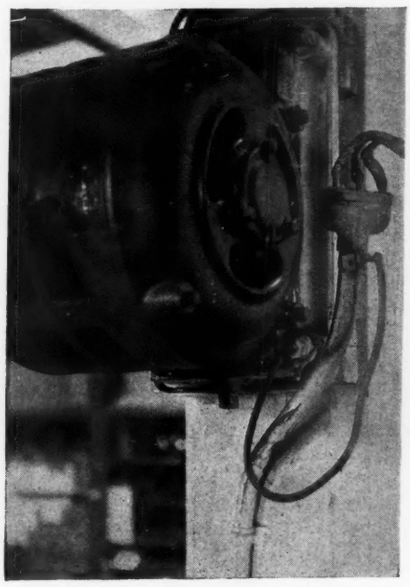
and

LIONEL A. HUNT
Service Engineer
Bepco Canada Limited, Toronto

SO MANY fatalities have occurred in recent months through improperly grounded plant equipment that it is high time management and maintenance executives realized the serious nature of such hazards. There is no better time than now to check over all grounding systems in the plant and put them in safe condition.

By grounding of equipment is meant connecting it by some means to the earth, so that its potential is the same as that of the earth. A piece of apparatus can reach a high potential relative to the earth by being "charged," or by the insulation breaking down on some current-carrying conductor that comes in contact with the apparatus framework. As water seeks a lower level, so does electricity, and the energized framework is awaiting an opportunity to discharge to ground. This it will do through a person who comes in contact with it and some conductor connected with the earth, such as a water pipe or building beam. Details of the accidents cited later were supplied jointly by the Workmen's Compensation Board of Ontario, and the Industrial Accident Prevention Association.

FIGURE 1. If the beam shrinks, the ground connection may be broken. The stranded ground conductor, without a lug, is held under the nut of a bolt in the wooden beam



Every plant will have its own peculiar problems, but some such policy should be adopted as that of a large packing plant having several scattered branches. In this instance a special bulletin was issued explaining what equipment should be grounded, why, and how to ground it.

Whenever the matter is handled in this way, the bulletin should state just what equipment in the plant in question should be grounded. In the packing plant mentioned, grounding was specified for the following equipment: (1) Conduit pipe; (2) motor frames; (3) electric switches and starting boxes; (4) electric heaters; (5) transformer cases; (6) portable equipment, such as drills; (7) transformers used for electric branders.

In a recent laundry fatality a short section of flexible conduit had either pulled out of its connectors at both ends, or had been originally too short to reach the connectors, and one of the 550-volt wires had chafed through inside it, the bare copper touching the conduit. A workman closing the switch, which was properly grounded, let his bare arm touch this charged conduit and was electrocuted.

A frequent cause of accidents is the improper grounding of motor frames. A motor should never be operated without a positive connection from its frame to the ground. In one plant a workman was found electrocuted on an overhead platform supporting a motor. A cigarette butt seemed to be evidence that he was sneaking a smoke. Silence pads under the motor insulated it from the grounded platform, the winding broke down to the frame, and another workman was the victim of an electrician's neglect, when he became the path over which the higher potential of the motor frame flowed to earth.

A similar incident occurred in a box factory when a siren started to blow continuously and the foreman climbed to the motor platform to investigate. While stepping over the belt to reach the siren he held on to the conduit overhead with his leg braced against the undergrounded motor frame. Small burns below

FIGURE 2. An unnoticed but real hazard was created when the main ground in a machine shop was accidentally broken

the knee and on his hand were the evidence that he, too, had been a victim of neglect.

Motor frames should have the ground wire soldered in or firmly clamped to a slotted lug, and held tightly under one of the end shield bolts. One reason for this recommendation is shown in Figure 1 where the ground wire was placed under the nut of a bolt passing through the beam. Shrinkage of the wooden beam might loosen the wire enough to break the connection.

Similar precautions to insure tight connections should be taken when grounding heater cases or transformer tanks. Ordinarily a ground wire should never be removed to allow a motor to continue to operate without blowing a fuse, since a very dangerous condition then exists. If some very exceptional circumstance arises in which a motor must be operated for a short time with the ground wire removed in order, say, to save a heat in a foundry, an electrician should guard the motor and prevent anyone from touching it.

Portable equipment, even that operating on 110 volts, claims many victims and therefore requires rigid inspection. All cable to portable tools should have an extra grounding conductor which should be readily distinguishable from the circuit conductors. Both plug and receptacle of the grounding connector for any portable device or equipment should be an approved standard. Adapters for use in lamp sockets should never be used. Where necessary on devices without an extra grounding conductor, a separate 30-ft. rubber extension cord with two spring clips can be used. One end of this cable should be attached to a ground, the other to the frame of the tool.

Four Electrocutions

What has been said above applies with equal force to extensions with brass sockets, particularly in damp places. We have the details of four instances in which workmen holding 110-volt extensions were electrocuted. Two of these accidents occurred while the men were cleaning out boilers.

Another man was the victim of a mistake made in wiring up a welding set. The white ground conductor was connected to the line at one end, and to the machine frame at the other. The red conductor was connected *vice versa*, causing the motor to run with some unbalance and reduced torque. Later the welder touched the set and his grounded work, and improper grounding claimed another life.

In the majority of cases in which an ungrounded machine frame becomes dangerous, an electrical fault has developed connecting the framework to the electrical supply. If a fault occurs when this framework is properly grounded, current flows down the ground conductor. If, as is often the case, there is no other ground on the system, this ground current may continue to flow without being discovered until a second accidental ground occurs on a different phase. It forms a short circuit and fuses blow, revealing the trouble.

FIGURE 3. A temporary jumper around this union might prevent a fatal accident

To indicate the occurrence of the first ground, some form of ground detector should be put in a conspicuous place. A number of commercial devices are available. In emergencies a home-made detector consisting of a lamp (or a sufficient number of lamps in series, for higher voltages) connected to each phase of the three-phase circuit, with the other three terminals joined together and properly grounded, may be used. Normally all three lamps burn dimly, but if an accidental ground occurs in the plant the lamp on that phase is short-circuited and goes out, whereas the other two lamps burn with full brilliance. Steps should be taken immediately to locate and remove all faults.

When equipment is installed it may be properly grounded, but the ground connection may become dislodged or broken in some way. Figure 2 shows a corner of a machine shop where a main ground has been torn off, possibly by leaning some heavy object against it. Therefore, the grounding of all equipment should be checked at least twice a year. Before disconnecting any water pipe line, the electrical department should be consulted to make sure that no grounds will be broken.

In Figure 3 is shown a common way of separating a union by using wrenches. If current is flowing down the ground at the right the workman himself will complete the circuit, with possibly fatal results, as soon as he breaks the joint. In any case like this a temporary jumper should be installed until the pipe is replaced.

Jumpers should always be installed around water meters or service unions to guard against a broken ground connection if the meters are changed.

Any Conductor Won't Do

It is sometimes believed that so long as some kind of conductor is attached between a machine and ground, all is safe. This is a fallacy, since the proper size of a ground conductor depends on the capacity of the system and the rating of the fuses. If a relatively small wire is used and an accidental ground occurs, the ground wire may burn off before the fuse goes, leaving an ungrounded, charged body awaiting an opportunity to discharge to ground. Grounding conductors for fixed equipment should, therefore, be of the following B. & S. gage sizes, based on the capacity of the automatic overcurrent devices ahead of the equipment:

Up to 30 amp.,	No. 14
Up to 100 amp.,	No. 8
Up to 200 amp.,	No. 6
Up to 400 amp.,	No. 4
Up to 600 amp.,	No. 2

No ground wires should be connected to any piping other than water systems (excluding sprinkler systems) having an ample length of network of pipe underground to insure low earth resistance. Where artificial grounds are employed, possibly by driving a number of rods or pipes into the earth, every precaution must be taken to insure that the resistance to earth will not exceed 25 ohms, or not be too high to prevent sufficient current from flowing to operate the fuse or circuit breaker protecting the equipment.

It is strongly recommended that artificial grounds be tested when installed, with a thorough inspection of all clamps. Tests and inspections should be made at sufficiently frequent intervals to insure that all grounds are in proper condition. A record of these tests and inspections should be kept for reference.

Pick Floors for the Job You Ask Them to Do

J. F. ANDREWS
Assistant Editor

Ruggedness gets the call over appearance and comfort when one chooses floors for moderate or heavy manufacturing service. Such floors were discussed last month. This article goes on from there to describe floor surfaces chiefly characterized by good looks and resiliency plus some ruggedness

•

FLOOR surfaces that are composed principally of cork are frequently used in offices and areas where light manufacturing operations are conducted. Linoleum and cork carpet are the best known members of this class.

Linoleum is made by mixing linseed oil that has been oxidized to a tough, rubber-like substance with ground cork, wood flour, and other ingredients, including pigments. The resultant plastic mass is pressed onto a burlap backing and slowly cured and dried under heat.

The finished product can be had in the form of tile or strips which are 6 ft. wide, in a wide variety of colors and decorative effects. Several thicknesses are available, up to ¼ in. maximum. In working areas and industrial offices plain linoleum is more commonly used. It is of one solid color throughout. When a more decorative effect is desired, printed or inlaid linoleum is used.

The former is made by printing a pattern on the surface of plain linoleum, with oil paint. When a covering is needed that does not show wear so quickly, the inlaid variety is used. It is prepared by arranging small pieces of colored linoleum in the desired pattern on a burlap backing. Since the color extends clear through, the pattern cannot be worn off.

More Resilient, Less Durable

So-called cork carpet contains essentially the same ingredients and is prepared in much the same way as linoleum, but is more resilient and porous, and less durable. It is ¼ in. thick, comes in rolls 6 feet wide, and can be had in a number of colors.

Less rugged than linoleum, cork carpet finds its widest use in places where a resilient, noiseless floor covering is needed.

Linoleum stands foot traffic well, but is not adapted to heavy trucking.

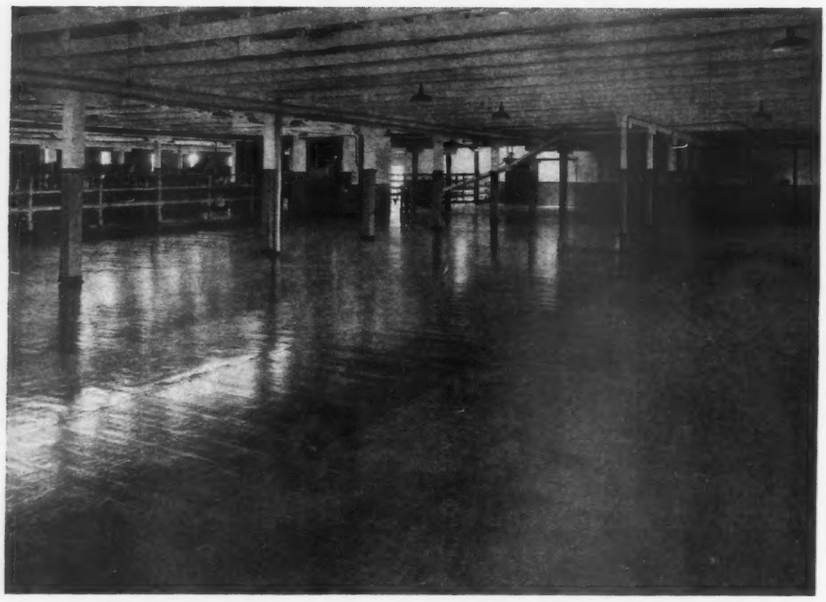
Fiberized mastic, another type of floor covering that is somewhat similar to linoleum in appearance, but entirely different in construction, is made from specially selected felt impregnated with asphalt and other materials. This material is available in the form of sheets and tile of different sizes, and comes in several dark colors. It is applied by cold cementing to the base, which may be wood or concrete.

It is moderate in cost, warm and resilient, resistant to acids and alkalis, and can withstand heavy trucking. The resiliency is sufficient to cause scratches or indentations caused by heavy loads or abuse to disappear within a short time. It is not adapted to locations where it is continuously exposed to the weather, or to oils, greases, or temperatures in excess of 120 deg. Fahrenheit.

Another fibrous flooring material is composed of leather and other fibers combined with asphalt and mineral filler, and cut so that only the ends of the fibers are exposed. Resilient and self-healing when cut, it stands heavy traffic and trucking.

Floor coverings of rubber tile or sheet are more frequently used in offices and lobbies than in manufacturing areas. They are composed of rubber combined with cotton or asbestos fiber, or cork, and are avail-

One large company uses an asphalt tile floor in its testing laboratory



A fiberized mastic floor covering in sheet form solved several problems in a raisin-packing plant

This asphalt mastic floor in a locomotive shop has to stand a lot of heavy trucking and abuse

able in a large variety of plain and mottled colors, so that highly decorative effects can be produced. Rubber-covered floors are resilient and stand traffic well, but are not adapted to heavy manufacturing or trucking. Moreover, they are comparatively expensive.

Asphalt mastic floor surfaces have long found considerable application in industrial plants, although they are fairly expensive. There are two general classes of such floors, that differ considerably in their composition and properties. Heavy asphalt mastic floors consist of asphalt, crushed rock, and sand or crushed rock screenings. When placed in sheet form, these materials are heated to about 300 deg. F., and rolled out to a layer from 1 to 2 in. thick.

Factory-made asphalt mastic blocks, which are formed under heavy pressure, are also available. These blocks are laid on cement mortar and the joints between them are filled with hot liquid mastic, or grout.

In the other type of asphalt mastic floor the asphalt is mixed with mineral oil, asbestos fiber, and pigment, and applied cold with a trowel to form a coating that is ¼ in. or less thick. This type of floor covering is suitable only for foot traffic.

Both types of asphalt mastic coverings are elastic, durable, water and acidproof, and stand traffic well. Heavy asphalt mastic floors will stand moderately heavy trucking, but are likely to be damaged when very heavy loads are handled.

Another type of floor covering consists of tough fiber and mineral filler mixed with a high-melting-point asphalt. After being compressed to a dense mass, the material is cut into slabs measuring 12 x 12 and 12 x 24 in., which are ¼, ⅜, and ½ in. thick. They can be had in red, brown, or black colors.

Slabs are fastened with a special cement to any suitable subfloor, of wood, concrete, or other construction. It is necessary that the slabs be firmly bonded to the subfloor.

This type of floor covering is capable of withstanding heavy trucking and rough usage, although static loads should be limited to about 100 lb. per square inch of bearing surface. Marks and scratches caused by trucking and blows tend to iron out under traffic. The material has considerable resiliency and is easy to work on, but should not be exposed to acids, oils, or any hot liquids.

Quiet and unobtrusive, lineoleum floor coverings are well adapted to factory offices and similar areas

Operating Shorts

Parts Would Not Slide Until Chute Was Corrugated

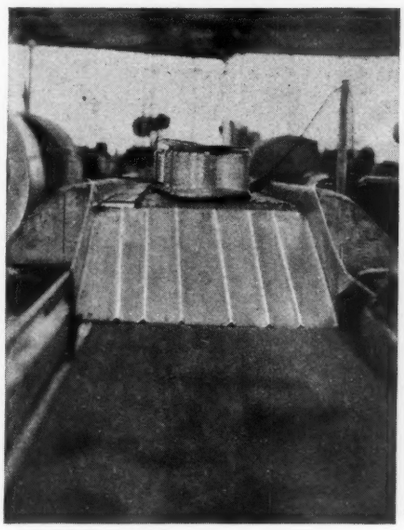
JAMES K. MATTER

Aluminum Products Company
La Grange, Ill.

In our cooking utensil plants it was necessary to discharge semi-finished aluminum shells from one belt conveyor to another situated at a lower level. For various reasons it was not practicable to use a roller conveyor to connect the two belt conveyors, nor was it possible to overlap them.

At first an ordinary steel chute was tried. This chute did not work because there was too much friction between the flat surface and the bottom of the shell. Greasing the chute did not work out either, and we came to the conclusion that the chute angle was on the negative side of the angle of repose.

Eventually, one of the toolmakers hit on the expedient of pressing longitudinal corrugations or ribs in the metal as shown in the photograph. These ribs reduced the area of contact from a flat surface to a line and cut down the frictional resistance. The shells immediately started sliding down the chute as easily as though they were moving over ball-bearing rollers.



Later the same scheme was tried on the shipping conveyor, to move cartons, and worked perfectly.

Mr. Matter's contribution has been awarded the $10 *payment offered by the editors for the best Operating Short submitted during the past month.*

•

They Got Together to Cut Costs

E. G. BROWN, *Foreman*
Remington Arms Company, Ilion, N. Y.

Results of a motion economy program opened our eyes to the possibilities for accomplishing cost reduction if everyone in the department took part in the work. We have extended this idea of group activity to the reduction of our controllable expense, in addition to suggesting new and better methods of manufacture. This has resulted in cutting departmental expense in half in the last 15 months.

It was the combined efforts of every last man in the department that brought about this reduction. A simple example of this cooperative activity is shown in these figures for cutting-oil expense, resulting from our attack on this cost item:

	Actual Expense	*Budget*
First month	$230.18	$74.27
Second month	222.76	84.80
Third month	182.05	73.40
Fourth month	73.17	137.42

First step in this work was to ask our laboratory to experiment and choose a less costly oil. This it did and excellent results were obtained from the oil it selected.

Next, the machine operators and machine setters consulted with the tinsmith in the design of splash guards. These save oil and eliminate the hazard of oily floors.

Thirdly, these men designed a chip pan with a false bottom drain from which 20 gal. of oil are reclaimed each week. The oil was formerly separated at a central station, and adulteration made it unfit for high grade work.

With the introduction of a night shift in the fourth month there would normally have been an increased oil cost but in the last part of the third month our group project had been completed and there was a decided decrease.

Our whole department is happier because we have learned how to work together and together we can accomplish much.

•

Keeping Track of Tools and Dies

JOHN H. STOUTENBERG
Plant Engineer's Office
Stanley Rule & Level Plant
New Britain, Conn.

Are you dependent upon the memory of one or two men to locate tools? The success of this system—if it can be called a system—varies as the memorizing ability of the set-up man. When he forgets locations, time is wasted; when he is absent, serious delays occur. By installing a simple, recorded-location system you can eliminate dependence on the vagaries of a human mind. Such a system was recently established in our pressroom die vault.

The die racks were divided into numbered sections. These sections were composed of 8 shelves, each of which accommodated 15 bins. Shelves were lettered and the bins numbered. Thus a die located in the fifth section, *B* shelf, fourth bin, would be numbered 5-B-4. Classification sheets such as shown in Figure 1 were made out for all sections. Steps then taken in the classification of the dies were:

1. Remove tool from bin.
2. Fill in information on the proper classification sheet.
3. Electrically etch part and location number on die.
4. Replace tool.

Sect. 5

Shelf	Bin No.	Part No.	Auth. No.	Part name	Use
A	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
B	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	P-505	N-30,347	Level top plate	Piercing and blanking

FIGURE 1

P 505 Name Level top plate

Die For	Auth. No.	Section	Shelf	Pos.
Piercing and blanking	N-30,347	5	B	4

FIGURE 2

This was done until every die had been catalogued. Library cards such as shown in Figure 2 were made out for each part number, and information was transferred from the classification sheets to the cards. The sheets were filed in the press-room general file and the library cards in a special file which is kept in an accessible spot in the time-keeper's office.

A few simple rules keep the system operating efficiently:

1. New dies shall have location stamped on them and be recorded before being placed in the vault.
2. Cards for discontinued parts shall be removed from the active file.
3. Replaced dies must be plainly indicated on their cards.
4. Dies must be kept in the locations for which they are marked.

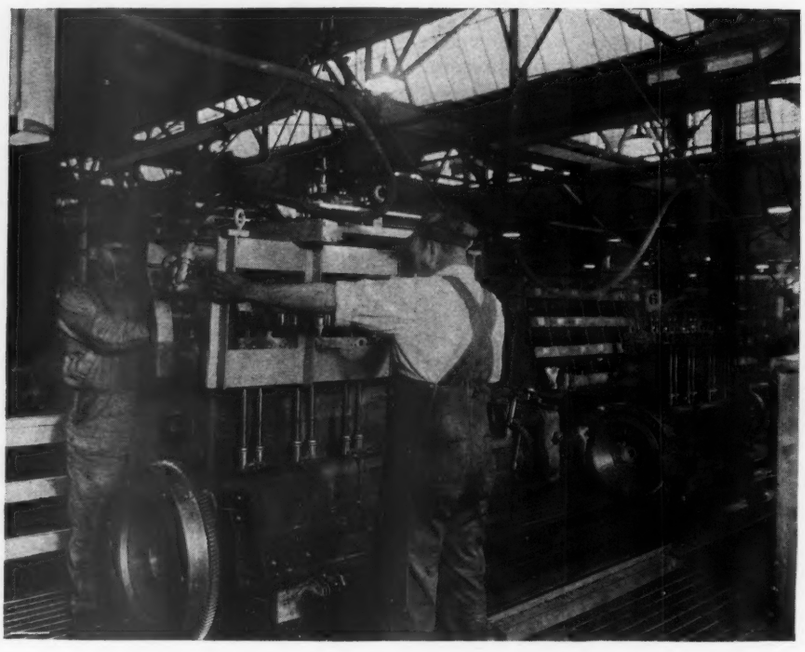
In actual practice, the set-up man memorizes die locations but consults the file whenever one is forgotten. Money is saved by spending less time locating dies, cutting down the non-productive time of the presses, and by being able to locate quickly obsolete dies which may be scrapped to cut down overhead.

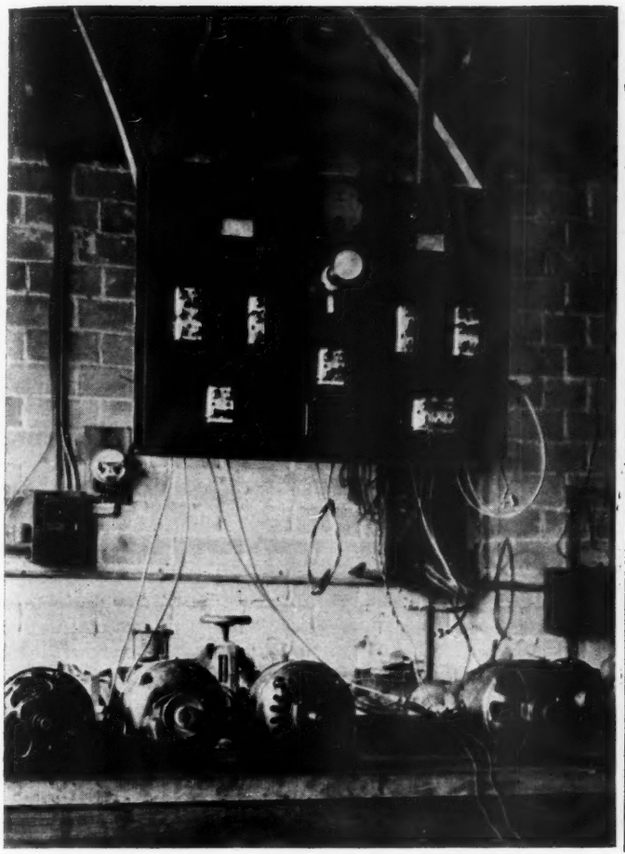
Nut Tightening Easier with Special Fixture

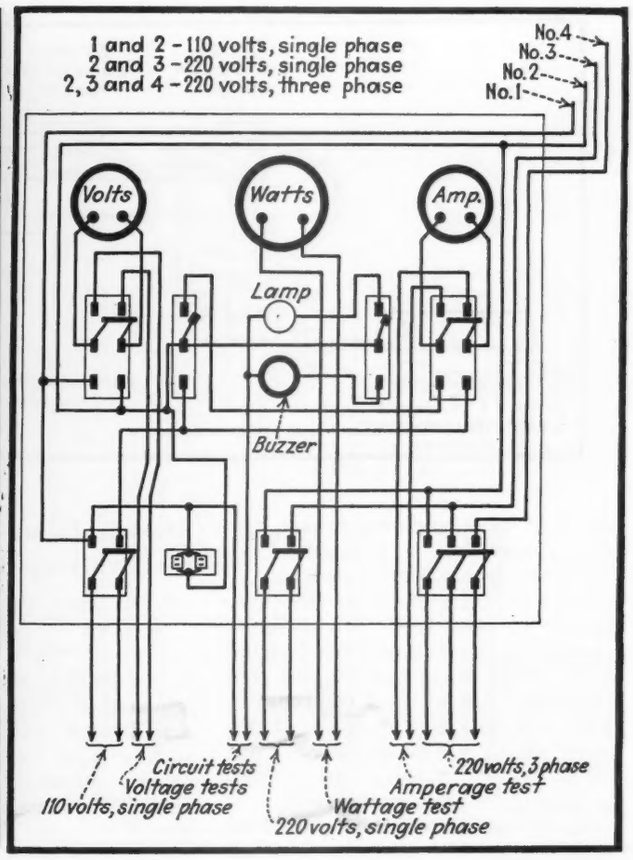
SOURCE, *Caterpillar Tractor Company Peoria, Ill.*

To assure absolutely precise tightening down of nuts at various points in diesel engine assembly, this concern employs wrenches that are driven by air motors. The air pressure is carefully controlled, the power of the motor using this air pressure is absolutely definite, therefore it is a simple engineering problem to apply this air pressure through an air motor of given rating and through a tool of specified design to assure that the nut is tightened down to, let us say, a pressure of exactly 53½ pounds.

Most of these applications are in hand-held portable tools. But at one place along the assembly line the required pressure—tightening down tie-rod nuts—is 75 pounds, and the job of controlling a hand tool was just too much for even the two husky workmen who had it. So a fixture was designed to take part of the load off the workman. This is a large rig suspended on a pulley with counterweight directly above the assembly line. Two men guide it onto the engine to be tightened, and it slides over the sides so that it is always absolutely plumb, which prevents any twisting on the rods. The device weighs 1,200 pounds, but the counterweight makes it easy to manipulate. Because of its rigidity it is speeded up far beyond the speed that could be controlled on a hand-held portable tool.







Test Panel Is Good Investment for Repair Shop

JACK BEATER, *Manager*
Harley Electric Co., Fort Myers, Fla.

For years we faced the problem of trying to prevent damage to or loss of electrical testing instruments, while our men wasted considerable time hunting for these portable instruments when they were needed on a rush job.

To overcome these troubles we recently built a permanent test panel and are no longer annoyed by broken, mislaid, or lost testing apparatus. Now, instead of picking up three or four different instruments and carrying them to the motor, we take the motor to the testing bench where equipment for every purpose is always available without loss of time. In addition to the saving of time and expense we have found that results are much more satisfactory from the standpoint of accuracy.

In order to save bench space we hung the test panel from the ceiling and brought in the feeders through regulation conduit. The panel is wired for 110 and 220 volts, single-phase, and 220 volts, three phase. Circuits are so arranged that two or three motors of different voltages can be tested at the same time.

Meters can be put either on or off the line while a motor is being tested. Also they can be used on the 110- and 220-volt single-phase lines, or on any one leg of the three-phase circuit. As will be seen from the diagram the board contains a wattmeter which is wired independently.

Service leads used for connecting motors under test to the panel are permanently fastened inside the panel box. This prevents them from becoming lost or borrowed for other purposes. Spring clips are soldered to the ends of all service cables. Small clips are also fitted on the wires used for taking independent voltage or amperage readings.

The test light and buzzer on the panel are connected to a pair of test prods and are used for trouble shooting and checking circuits inside the motors. A spring scale suspended from the ceiling, a rope, and an assortment of pulleys not shown in the photograph are used for torque tests.

A duplex receptacle mounted on the panel is used for plugging in small appliances provided with a cord and plug.

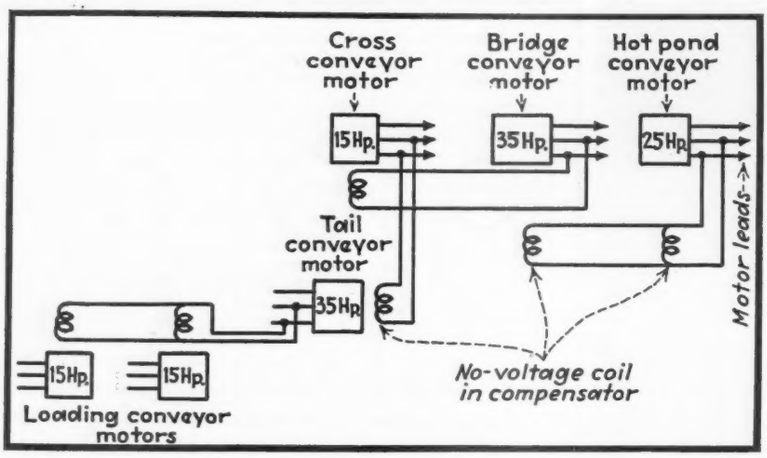
Costly comebacks have been practically eliminated since the construction of the test panel, and it is now one of the most useful pieces of equipment in the shop. It has also been responsible for the securing of many new accounts, and has earned its cost many times over in the short space of one year.

A baker in an Eastern State first saw glass bricks at the Chicago fair, went to Florida last winter, saw them again in a private home. Today he is using them in a large new cake room which he has under construction.

Conveyor Motors Interlocked for Automatic Stopping

C. E. ROGERS, *East Angus, Quebec*

Our conveyor system for handling wood covers a total distance of 1,500 ft. and consists of six separate conveyors operating in series. Stoppage of one conveyor in the series formerly caused pulp wood to pile up until an attendant arrived to shut down the other motors. Frequently



gears or sprockets were broken, and then there would be a lengthy shutdown and heavy repair costs.

Since the motors driving these conveyors operate from two different circuits the method of control shown in the illustration was adopted. The no-voltage coil of each compensator was connected to the leads of the motor ahead, so that stoppage of any motor results in the shutting down of all motors back of that one.

In winter all of this equipment must operate in temperatures as low as to —50 deg. F. Therefore, special winter switch oil is used and strip heaters are placed under the oil pan of each compensator to keep the oil from congealing.

•

Jack Facilitates Wedging of Stator Coils

C. A. EDWARDS, *Chief Electrician*
The Long-Bell Lumber Company
Ryderwood, Wash.

The article by C. E. Rogers, which appeared under the above heading in the October issue, was interesting to me because we have used the same scheme for several years. The first equipment was made from an automobile jack.

We are now using an air cylinder to produce the required pressure, and it has speeded up the work considerably. With 90-lb. air pressure we get about 500 lb. pressure on the coils.

A Connecticut manufacturer finds wooden exhaust ducts best for use over plating tanks. Painted with an asphaltum paint they outlive the metal variety.

Electric Floor-Type Heaters for Drafting Room

L. N. DAVIS, *Plant Superintendent*
Douglas Aircraft Company, Ltd.
Santa Monica, Calif.

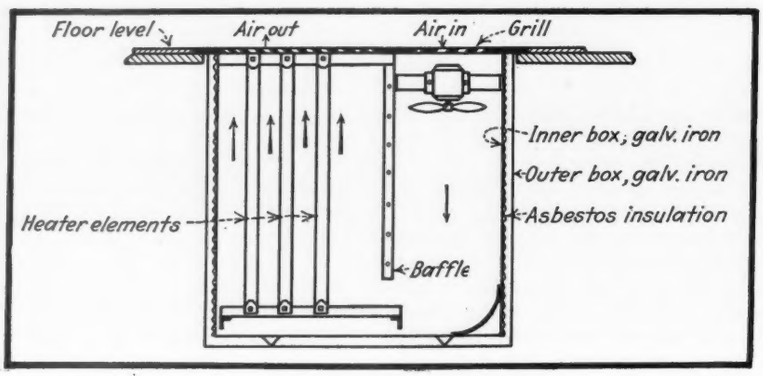
The drafting room in our old plant was heated with gas, and considerable trouble was experienced from curling and shrinking of tracing paper, evidently due to peculiar humidity conditions. This circumstance was one of the reasons for our decision to heat this department in our new plant with electricity.

A floor-type electric heater utilizing standard industrial strip heaters and a small electric fan was eventually designed by the writer. Forty of these heaters, each having a capacity of 6 kw. were installed in the drafting room. Provision was made for the installation of a fourth 2-kw. strip heating unit, in each heater, if necessary.

Heaters consist of a double-walled, galvanized-iron box divided into two compartments by means of a baffle. Asbestos and a liberal air space provide the necessary insulation between the walls. The floor grill has slots set at one angle for the intake compartment, in which the fan is located, and at an opposing angle on the outlet side. These slots thus direct the flow of warm air along the floor level, rather than vertically toward the ceiling.

Automatic control of the heaters is provided by thermostats. In addition, suitable provision has been made so that the heating load cannot increase the maximum demand of the plant.

The heating elements are supplied from a 440-volt circuit, whereas the fans operate at 115 volts. A separate switch on the fans makes it possible to utilize them for air circulation in the summer months, when no heat is necessary.

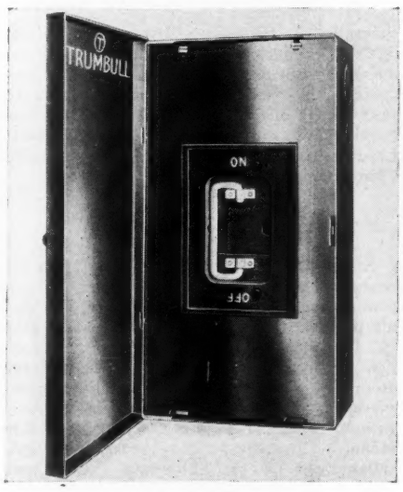


Small orders calling for particular color shades are usually unprofitable. One manufacturer grabbed the bull's horns, standardized 8,000 shades at 209. Now he makes a profit; the trade finds it easier to specify what it wants, that 209 colors are enough in most any man's fair land.

Special Notice

$10 will be paid for the best Operating Short submitted during the month of January. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

What's NEW in Equipment



Switches

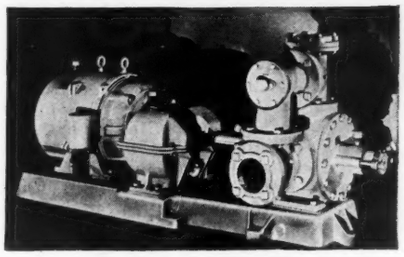
Type H Fuse Puller switches for use in connection with main branch circuit service. Sizes: 30 and 100 amp. Can be supplied with 2-8 plug fuse branch circuits in flush- or surface-type boxes. The Trumbull Electric Mfg. Co., Plainville, Conn.

Electrode

A coated electrode, "Chromeweld 4-6," for welding low-chromium steels. Contains molybdenum. Steels welded with this electrode can be soft annealed to properties similar to those of mild carbon steel, it is claimed. Available in diameter sizes of 1/8, 5/32 and 3/16 in. The Lincoln Electric Co., Cleveland.

Pumps

Integrated rotary pumping units have pump, motor, and inclosed gears mounted on special base. Single units have capacities 35-700 gal. per min., twin units 50-100 gal. per min. Full-capacity by-pass. Easy to clean, full flow strainer. Blackmer Pumps Co., Grand Rapids, Mich.

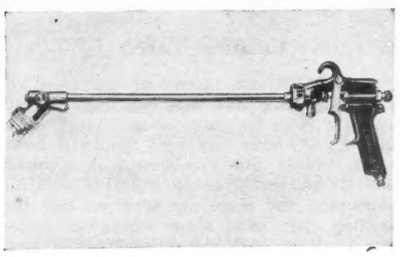


Socket Wrenches

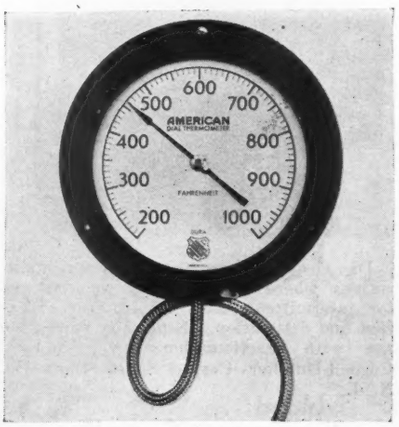
No. D set has assortment of 10 sockets for ½-in. square drive and ratchet handle with lug. Sockets have double-hexagon openings ranging 7/16–1 in. All parts made of chrome-vanadium steel and chromium plated. Set No. D1 is same as set No. D except that it is supplied with 15-in. hinge handle. Both sets packed in black enameled metal boxes. Bonney Forge & Tool Works, Allentown, Pa.

Spray Gun

Thor Model 7 spray gun with extension arms for spraying in inaccessible places. Extensions vary in length from 12 to 30 in. Five styles: straight, 45 deg., 90 deg.,



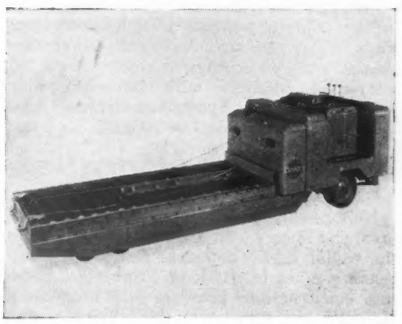
internal and external atomization type, and circular extension spray for spraying inside of pipes, barrels, etc. Extension heads may be swiveled in any direction. Needle valve seats in material nozzle. Binks Mfg. Co., 3114 Carroll Ave., Chicago.



Thermometer

Dial thermometer, "Dura," has range —40 to +1,000 deg. F., uses mercury as actuating medium. Stainless steel bulb, socket, and connecting tube. Dial can be positioned to zero from back of the molded plastic case without removing the dial. Non-breakable glass is held by plastic ring and moisture-proof gasket. Case is moisture and dust proof. Consolidated Ashcroft Hancock Co., Inc., Bridgeport, Conn.

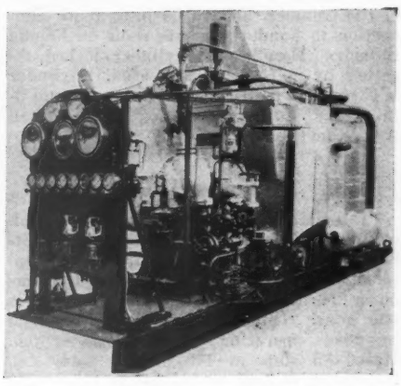
Truck



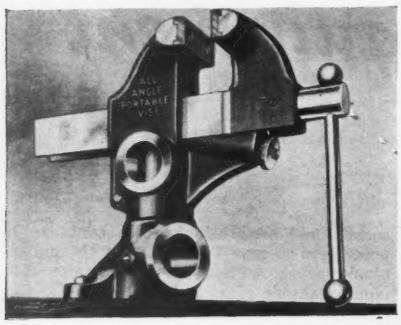
A 10-ton elevating truck with power-driven roller conveyor platform. Built especially for handling packages of sheet steel, it has cables with hooks attached connected to electrically driven double drum to hold packages on truck. Truck is 18 ft. overail in length, platform is 10 ft. long by 50 in. wide. Separate motor for each motion of the truck. Baker-Raulang Co., Cleveland.

Steam Generating Unit

The "Steamotive" steam-generating unit consists of boiler, meters, control equipment, and auxiliaries mounted as a self-contained unit. It is relatively light in weight and requires minimum of space so that it can be transported as a unit. Steam is generated at high pressure and temperature. Units are intended for capacities of 2,000-10,000 hp. Combustion liberation up to 400,000 B. t. u. per cu. ft. per hr. is



claimed. Quick starting from cold condition. General Electric Co., Schenectady, N. Y.; The Babcock & Wilcox Co., 85 Liberty St., New York; Bailey Meter Co., Cleveland.



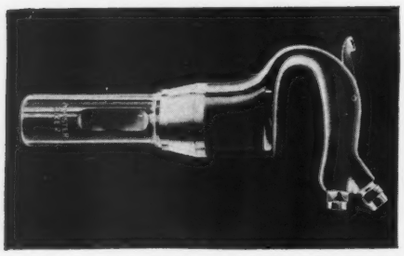
Vise

Bench vise mounts on tubular post which is mounted in base bolted to work bench. Work can be locked in vise at any angle in any of four planes. Can be used sideways. Two sizes available in either machinist or woodworker models. Made of alloy-steel castings with interchangeable jaws. Police & Sportsman Supply Co., South Vermont Ave., Los Angeles.

Pillow Block

Roller-bearing pillow block for service involving heavy end thrust in addition to the radial load. Separate heavy duty ball bearing takes thrust load. Spherical housing construction provides self-alignment. Housing is two-part, is oiltight, and equipped with leveling device for oil lubrication. For shaft sizes ranging 3 5/16-10 in., with radial load capacities up to 250 tons. Fafnir Bearing Co., New Britain, Conn.

Chipping Hammer



Pneumatic chipping hammer has valve block which is claimed to last through life of the hammer. Extra bushing at air connection to handle prevents wear on handle threads. Handle and cylinder locked together by coil spring and stud. Cylinder is chromium plated. Made in 1-, 2-, and 3-in. stroke. Master Tool Co., 5605 Herman Ave., Cleveland.

Timing Unit

"Inter-Matic" timing unit has "on-and-off" clips attached to synchronous-motor-driven dial, of which 10 pairs can be applied. Dial is laid out in 15-min. divisions on a 24-hr. cycle. Minimum interval is one hour. Clips operate trip mechanism in turn operating single-throw switch. Rated 35 amp. at 115 or 230 volts a.c., non-inductive load, or 1½ hp. at 115 or 230 volts a.c., inductive load. Manual control can be supplied in addition to dial clips to open or close contacts permanently or temporarily without affecting clip setting. Type HC is arranged for wall or conduit mounting with wiring connected at terminal block. Type HS is intended for meter socket mounting. International Register Co., 15 South Throop St., Chicago.

Hand Truck

Hand truck for handling packages has three perforated metal sides made of 16-gage reinforced metal and standing 36. in.

high. Dimensions are 60x36 in. Two 10-in. center wheels and two swivel casters have tires and roller-bearings. At each end is a handle. Service Caster & Truck Co., 505 North Albion St., Albion, Mich.

Cutting Torch

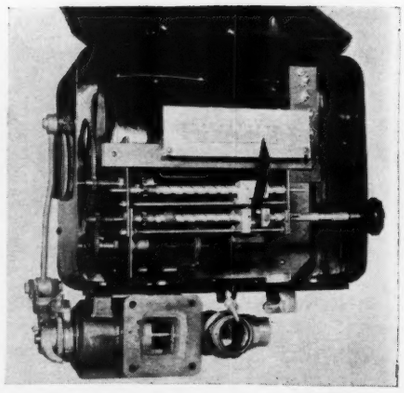
Rego RTK attachment when applied to company's SX and GX welding torches converts them for gas cutting. After welding tip assembly has been removed from torch handle this attachment is screwed on. It can cut iron or steel up to 3 in. thickness, and there are separate tips for cutting cast iron, sheet metal, or other stock. Bastian-Blessing Co., 240-258 East Ontario St., Chicago.

Capacitors

Dry electrolytic capacitors for a.c. applications where high capacity is necessary for intermittent use. Rapid heat radiation and dissipation. Especially suited for use with fractional-horsepower motors. Cornell-Dubilier Corp., South Plainfield, N. J.

Temperature Controllers

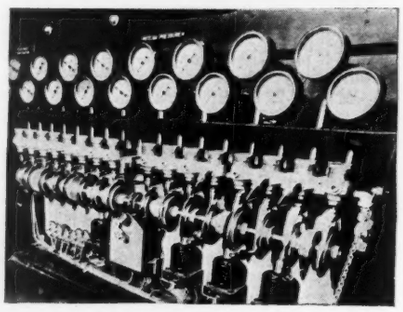
For controlling furnace heating rates. Consist of standard proportioning valve driven by reversible motor. Upper limit switch is automatically adjusted by small reverse motor operated by a contact in the



controlled instrument. Lower limit switch is fixed. Dustproof metal case with glass-inclosed indicator showing extent of valve opening. Adjustment of valve opening is said to be directly proportional to time required for temperature to reach normal. Lindberg Engineering Co., Union Park Court, Chicago.

Compressor

Steam-driven, single-stage, horizontal compressor. Double-acting for air or gas compression. Steam pressure 80-250 lb., air pressures up to 150 lb. Sizes 279-1,987 cu. ft. per min. Steam cylinder is in tandem with air cylinder and is lagged for steam economy. Steam valve is balanced piston type. Fly-ball governor for steady pressure, flywheel governor for variable steam with steady air pressure. Air cylinder liner is cast alloy and valves have laminated cushion backs. Sullivan Machinery Co., Michigan City, Ind.



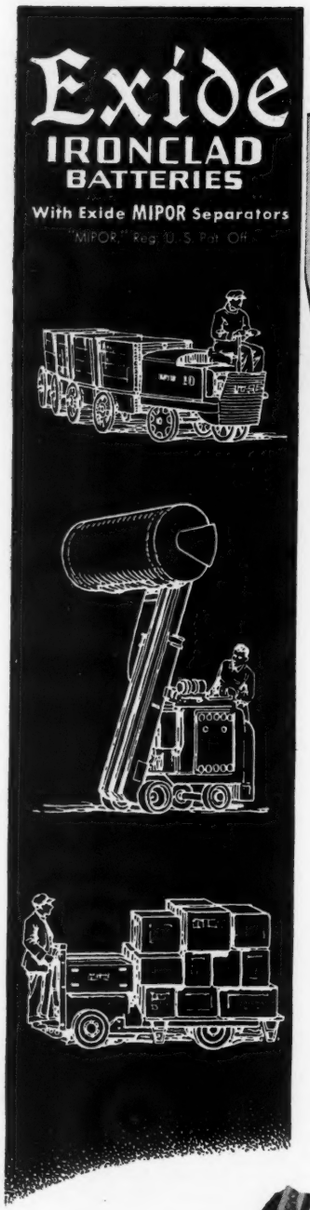
Process Control

"Coordinated Control System" for automatically operating intricate industrial processes. Can be applied to processes requiring close control for quality, to processes difficult to control manually, it is claimed. Built in form of master control station, it consists of standard recording and controlling instruments built around a so-called "mechanical brain." The Bristol Co., Waterbury, Conn.

Welder

"Series MN Current Saving Models" are arc welders embodying "Selective Motor HP Control" for economical control of the motor. With this, it is possible to use equivalent of a motor with one-half the horsepower rating for welding in ranges up to one-half or two-thirds of rated generator capacity. Only one-third usual starting current is required, it is said, and power factor and efficiency are im-

(Continued on page 82)



"NO TROUBLE, NO REPAIRS with our six-year-old Exide-Ironclad Batteries"

A PROMINENT electric industrial truck user writes us this letter—"Six of our Exide-Ironclad Batteries are approximately six years old and are still giving satisfactory service. During this time, *we have never had a failure nor any repair expense.*"

A single case like this might be exceptional. But hundreds of such reports—all saying substantially the same thing—show that long life and minimum maintenance are a habit with Exide-Ironclad Batteries.

Truck illustrated made by The Yale & Towne Manufacturing Co.

Here is some indication, based on actual experience, of what you can expect from these batteries in material handling service. They are *built* to deliver exceptionally long life, to stay on the job and out of trouble, and to do so with an absolute minimum of maintenance. That's why they can improve your material handling service and cut costs. Write for free booklet, "In Selecting Any Motive Power Battery, Be Sure."

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

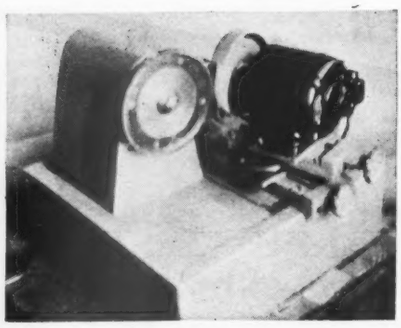
The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

proved. Speed control is operated by hand by setting handle in low or high positions. Available in ratings: 75 amp., 1½-3 hp.; 100 amp., 2½-5 hp., 150 amp., 5-10 hp.; 200 amp., 7½-15 hp.; 300 amp., 10-20 hp.; 400 amp., 12½-25 hp.; 600 amp., 20-40 hp. Hobart Bros., Troy, Ohio.

Knife Grinders

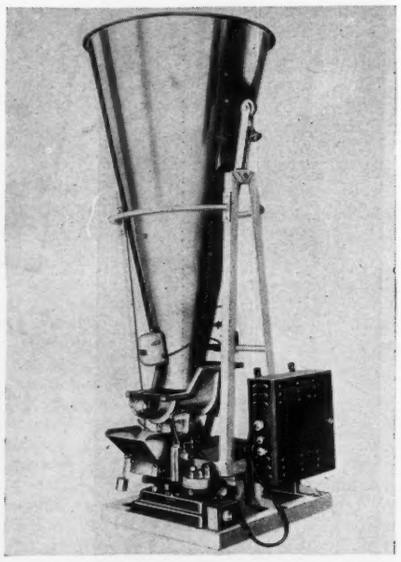
Types CC1 and CC2 circular knife grinders for single or double bevel knives or disks. Bench or floor types. Type CC1 for knives up to 14 in. diameter, type CC2 for knives up to 20 in. diameter. Have cabinet base construction and entire assembly is self-contained with control switches mounted in the base. Knife is mounted on adjustable arbor and is revolved by separate motor with V-belt drive. Grinding wheel is 6x½ in. (8-in. wheel on special order)



and is mounted directly on arbor of motor. Entire assembly has adjustable slide mounting. Two ¼-hp. motors are used. Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y.

Batch Weighing Machine

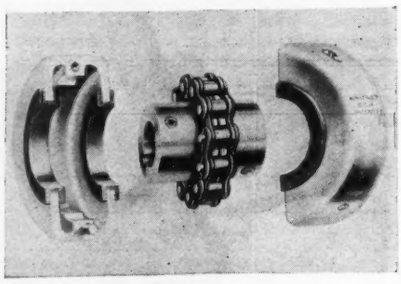
Automatic precision batch weighing machine for batching and filling operations on dry materials. Scale has two electrical controls, one for cutting out high-speed feed when 80 per cent of batch is weighed, and one for stopping slow dribble feed when exact weight is reached. Range of sizes. Three types of control: one is automatic, electrically timed continuous mechanism that weighs out batches and dumps them at definite rate per min.; second dumps scale hopper automatically as soon as batch



comes to weight; third allows manual dumping of hopper. Syntron Co., North Lexington Ave., Pittsburgh.

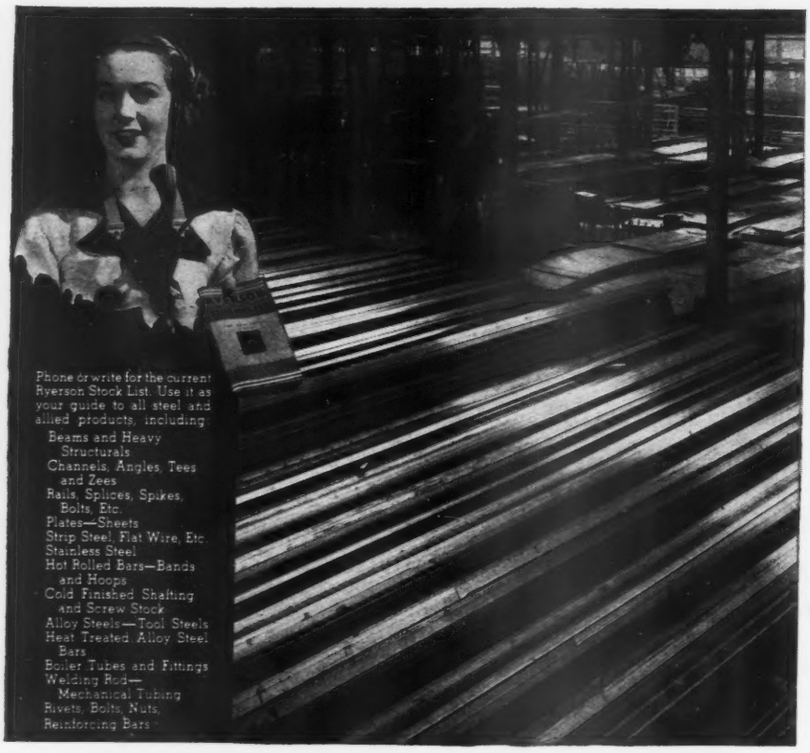
Flexible Coupling

Improved "Roller Chain Flexible Coupling" is made with a wide chain design to give maximum chain roll and sprocket-tooth bearing area. Single-chain design allows shearing stresses to be taken by combined cross-section of chain pin, bushing, and roll. Lugs on each half of the aluminum cover grip the roll and give positive cover drive. Coupling and cover can be disconnected without disturbing shafts. The Whitney Chain & Mfg. Co., Hartford, Conn.



Reducing Valve

Style A auxiliary or pilot-operated pressure-reducing valve for steam or air. Will reduce high pressures to delivery pressures from 1 to within 20 lb. of supply pressure. Can be used where sudden variations in demand occur. Change from high reduced pressure to low reduced pressure made by changing regulating spring and diaphragm. Up to 250 lb. and 500 deg. F. standard


Phone or write for the current Ryerson Stock List. Use it as your guide to all steel and allied products, including:
Beams and Heavy Structurals
Channels, Angles, Tees and Zees
Rails, Splices, Spikes, Bolts, Etc.
Plates—Sheets
Strip Steel, Flat Wire, Etc.
Stainless Steel
Hot Rolled Bars—Bands and Hoops
Cold Finished Shafting and Screw Stock
Alloy Steels—Tool Steels
Heat Treated Alloy Steel Bars
Boiler Tubes and Fittings
Welding Rod—Mechanical Tubing
Rivets, Bolts, Nuts, Reinforcing Bars

Thousands of Tons of Steel in Stock for Immediate Shipment

HERE is steel in every shape and size in standard and alloy grades—in stock for Immediate Shipment. Allied lines such as welding rod, babbitt, boiler tubes, and fittings are also carried. Shears, saws and special flame cutting equipment quickly cut to any length or special shape. Whatever your requirements you can call on Ryerson with full assurance that everything possible will be done to deliver the material well within the time specified. Ten plants stand ready to serve you. Draw on the nearest one.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Detroit, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

RYERSON

construction is used. Sizes ½ and ¾ in. are of bronze, 1 in. and larger cast iron. Bronze internal parts, cast iron piston rings. For pressures up to 400 lb. and superheated steam of 750 deg. F. cast steel bodies with stainless steel internal parts are used, with the exception of ½- and ¾-in. bodies which are of special alloy. Schade Mfg. Co., North Bodine St., Philadelphia.

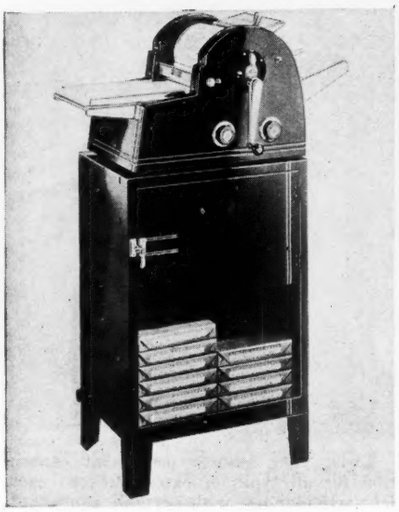
Insulation

Glass-wool insulation for refrigerated and heated equipment using temperatures up to 1,000 deg. F. Said to be moisture, fire, and rot proof. Will not absorb fumes. Comes in several forms in densities 1½-6 lb. per cu. ft. Armstrong Cork Products Co., Lancaster, Pa.

Regulator Valve

Combines functions of solenoid-operated stop valve and pressure regulating valve to control flow of water or air, and pressure at which liquid is delivered from valve. Can be used in air conditioning to control water flow to sprays in humidifying equipment. Valve is equipped with strainer. Outlet pressures 5–50 lb. or higher; maximum water pressure 100 lb. Sizes ¼–3/8 in. General Sales & Products Corp., Cohoes, N. Y.

Duplicating Machine

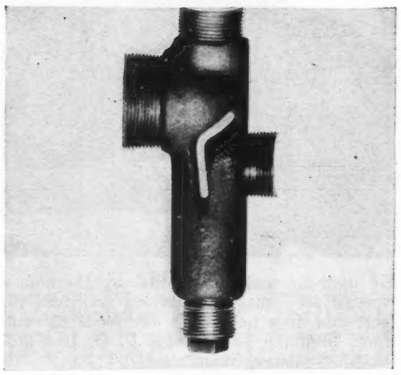


Makes up to 200 copies from writing, typing or drawing original. Uses special carbon paper available in four colors. Any size up to 14x17 in. can be used, and paper up to card stock can be handled. Hand-operated or motor-driven models. Ditto, Inc., West Harrison St., Chicago.

Ball Bearings

Series "9000" self-sealed precision ball bearings. Types "9000-D" has single side shield; type "9000-DD," two side shields. Shields are inwardly extending, closely fitted flanged type, which do not rotate or contact with rotating seal parts and which retain grease in horizontal or vertical position. Available in full range of sizes and interchangeable with single felt seal bearings of wide outer ring type for 6 mm. to 26 mm. in bore. Norma-Hoffman Bearings Corp., Stamford, Conn.

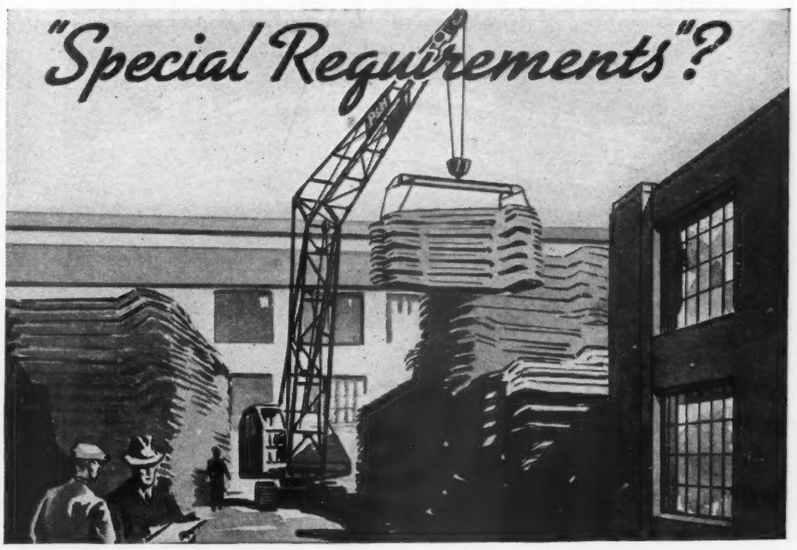
Dirt Pocket



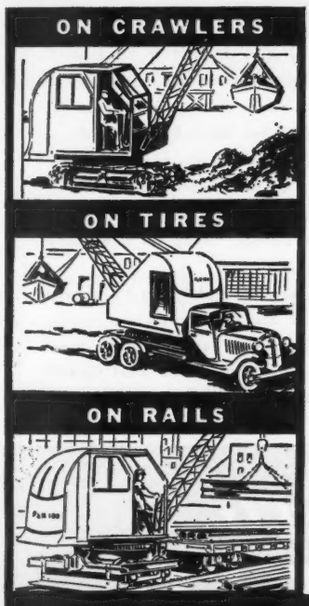
Series 26 Dirt Pocket is special pipe fitting for ends of low-pressure lines with dirt trap in lower part. Baffle traps the dirt and deflects steam away from trap connection. On one side of fitting connection can be made to horizontal run of pipe, on the other to a drip trap, on the top to a riser. In four pipe sizes, 1¼–3 in. Warren, Webster & Co., Camden, N. J.

Air Conditioner

Unit conditioner cools, cleans, dehumidifies and circulates, 1,200 cu.ft. per min. Conditioned air is distributed through grille at top of 6¼-ft. high unit. Has reciprocating-type radial compressor inclosed in base. Power rating is 3 hp. Covers floor space 20x33 in. Airtemp, Inc., 405 Lexington Ave., New York.



P&H HAS ALL THE ANSWERS



TO "OUTSIDE" HANDLING

In more than 50 years' experience building material handling equipment, we've seen mighty few cases where we didn't have the answer before it was asked. "Specials" have become a standard order for P&H engineers. They understand the requirements of your product, yard conditions, types of loads, etc. Any P&H engineer can give you sound advice built on long experience with "outside" handling problems. Why not call one in? Or write for Bulletin CC-1?

HARNISCHFEGER CORPORATION

4525 West National Avenue Milwaukee, Wis.

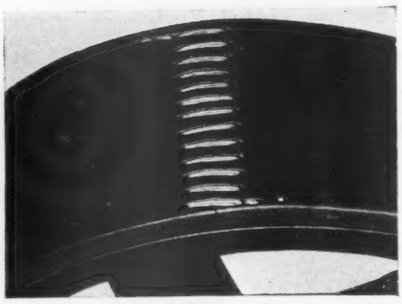
P&H CRAWLER-TRUCK & "SWITCHER" CRANES

Lift Truck

Power lift truck has tilting platform which is tilted by chain-operated sprocket. Chain connects to sprocket on hoisting unit. Two other chains lift platform in the vertical upright. Capacity is 4,000 lb., maximum height 62 in. above floor. Platform dimensions are 66x36 in.; it can be tilted to angle of 32 deg. with horizontal. All four wheels steer; turning radius is 112 in. Yale & Towne Mfg. Co., Philadelphia, Pa.

Belt Lacing

Non-metallic belt lacing "Tek-Lace" for fastening flat or V-belts. Is 0.055 in. in diameter; has tensile strength of 100 lb., it is said. Ordinary awl or piercing tool can



be used to make fastening, or there is a special tool available. Lacing sets into the belt and does not stand out from the surface. Sudbury Laboratory, P. O. Box 905, South Sudbury, Mass.

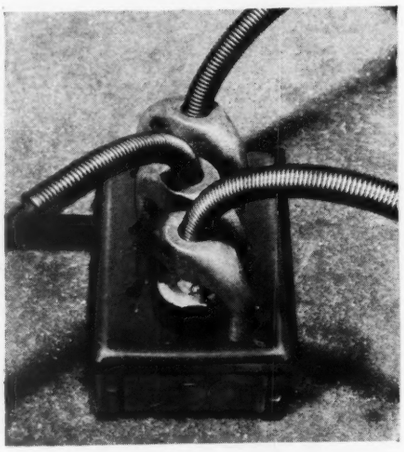
Air Conditioning System

Air-circulating and humidifying system controls relative humidity, room temperature, and dew point. Air trunk extends from windows almost to center of the room. At window end are two dampers, one controlling incoming fresh air, the other controlling recirculated air. Dampers are so arranged that when one is open other is closed. Air is propelled by fan in the trunk. Openings on one side of each trunk are made to point in one direction on one side of the room, and in opposite direction on the other side, so that the air is circulated. Humidifiers are placed on posts in direction of the air current. Bahnson Co., Winston-Salem, N. C.

Relay

Auxiliary relay HGA opens and closes circuit, operates on either a.c. or d.c. circuits. Double-pole, with 2 or 4 contacts. Furnished with operating coil for 1–5 amp. d.c.; 6, 12, 24, 32, 48, 125, and 250 volts d. c.; or 115, 230, 460, and 575 volts a. c. By adding external resistor it can be used on higher-voltage d.c. circuits. Stationary contacts are silver tipped and will carry 30 amp. for 1 min. or 12 amp. continuously. Parts in magnetic circuit are of silicon steel and cadmium plated. Back-connected. General Electric Co., Schenectady, N. Y.

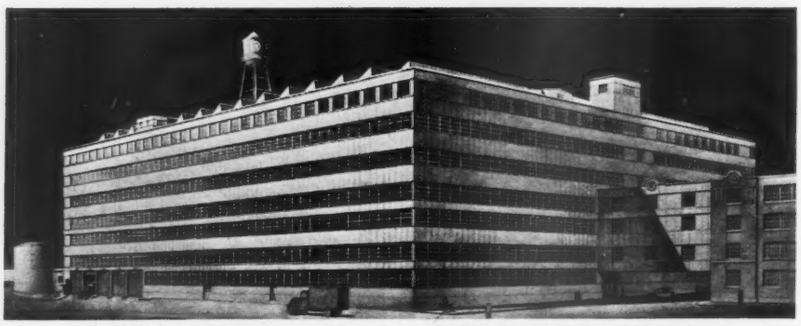
Extension Cord Yoke



Twist yoke assures permanent connection for all types of extension cord caps. Of particular use with portable equipment, it can be adapted to any standard outlet box. A slight turn secures locking pin in countersunk holes. Rubber gasket under outlet cover guards against dirt shorting the contact. Logan Sales Co., Los Angeles.

Switch

Mercury switch is contained in a cadmium-plated metallic housing which can be clipped into a circuit in the same manner as a cartridge fuse. As switch is tilted in one direction, contact is made through mercury and refractory bushing between two sections of the housing. When switch is tilted the other way contact is broken. Series 300 is rated 5–15 amp. on 110 volts, a.c., 5–10 amp. on 200 volts, a.c., 5–12½ amp. at 110 volts, d.c. Series 400 has same rating but housing is covered with insulating sleeve and leads. Series 300-E has same rating, but has insulation between the two sections of the housing. Electric Switch Corp., Columbus, Ind.



Prack & Prack Architects — Rust Engineering Co., Contractors

WESTINGHOUSE

Chose THESE HEAVY-DUTY FLOORS

After tests conducted at their own factory, Westinghouse Electric and Manufacturing Company used 150,000 square feet of Fenestra Holorib Steel Floor Forms as permanent supports for heavy-duty concrete floors in this mammoth new Warehouse at Mansfield, Ohio.

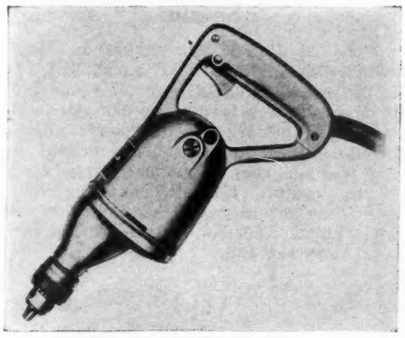
Twenty-gauge Holorib sheets in 10'3" lengths, with triangular ribs turned up, were laid on 5' beam spacing with 3" telescoping end laps. Concrete was poured into this permanent form (see illustration) to a depth of 3½", the steel ribs being thus bonded and keyed into the floor on the under side.

Advantages of this construction were at once apparent: It was rapidly laid. The steel sheets were welded to the girders providing extra stiffness, and furnishing a platform immediately available for other trades. The telescoping end laps and nested side laps formed a solid steel mould, eliminating leakage. Lower floors were kept clean. As no wooden forms were required, the labor of removing these after the concrete set, was eliminated. The under side of the Holorib form became an attractive steel ceiling presenting a clean, dry surface, ready for immediate painting.

Interesting and helpful data on Holorib Roof Decks and Floor Forms are quickly available. Drop a line to Detroit Steel Products Company, 2258 East Grand Boulevard, Detroit, Michigan.

Fenestra HOLORIB

ROOF DECKS FLOOR FORMS



Drill

OB-8 portable electric drill is designed for intermittent service. A one-quarter in. drill, it has an air-cooled handle, trigger-type switch in handle with lock for continuous operation. Motor operates on 110-120 volts, 25-60 cycles a. c., or d. c. No load speed is 2,950 r. p. m. Aluminum alloy housing, bronze bearings with thrust ball bearing on spindle shaft. Length is 12 in. Signal Electric Mfg. Co., Menominee, Mich.

Valve

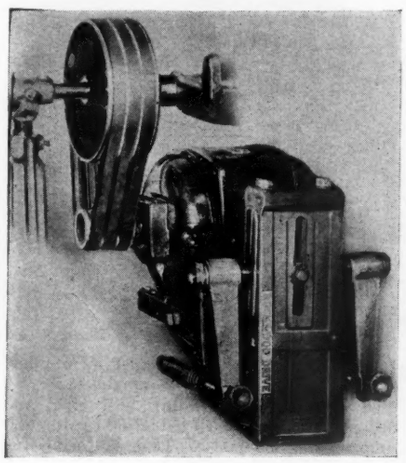
Solenoid-operated gate valve designed for emergency stop service. When solenoid is energized, or de-energized if arranged to operate on loss of current, latch holding manually set lever strikes a blow, releasing lever. Connection of lever to stem is slotted so that lever first moves freely, then strikes second blow to overcome resistance of packing friction. Cast iron valve body comes in screw or flange design. Sizes range 2–8 in. Working pressures: 125 lb. for steam, 175 lb. for liquids. Ruggles-Klingemann Mfg. Co., Salem, Mass.

Sealing Pliers

"Lead Seal Press No. 24" for closing lead seals has one set jaw insert and one insert provided with changeable knurled head. Jaw operates in straight line. Compound lever design makes possible one-hand operation. Overall length 5½ in. Utica Drop Forge & Tool Co., Utica, N. Y.

V-Belt Drives

V-belt drives on pivoted motor bases. Pivoted bases maintain constant belt tension, taking up belt stretch, and eliminating belt slip. When drive is not running tension is removed from the belt. Rockwood Mfg. Co., Indianapolis.



Oils

All-petroleum oils having viscosity index of 150 are particularly suitable for use where constant viscosity is necessary and where temperature variations are encountered. Adaptable to use in hydraulic control apparatus, instruments, variable-speed equipment. Available in 1- and 5-gal. cans, as well as in large quantities, and in viscosities above 100 Saybolt sec. at 100 deg. F. Standard Oil Co. of New Jersey, 26 Broadway, New York.

Hoist

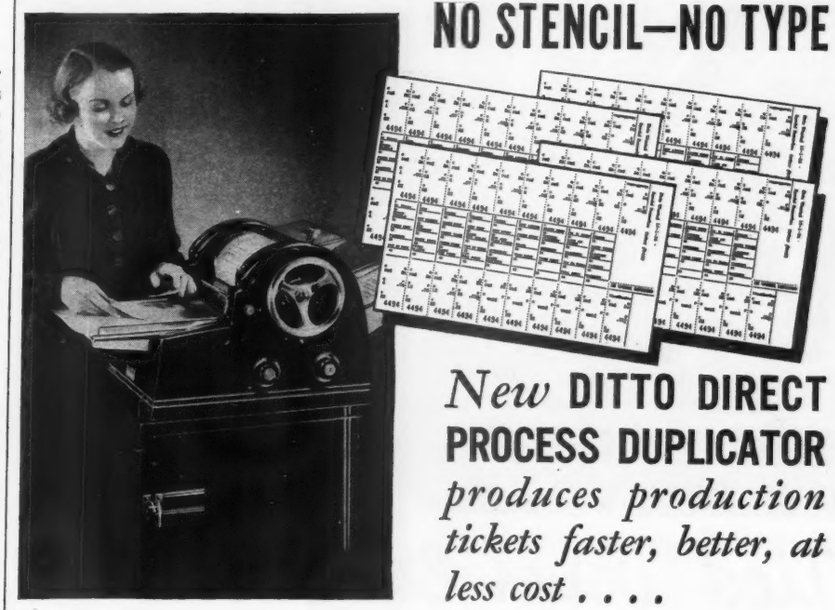
Junior Type high-speed hoist for use where headroom is close. Has hoisting speed of 60 ft. per min. Has single cable lift of 15 ft., rope or pushbutton control. For 250 lb. capacity ¾ hp. motor is used; for 500 lb., 1½ hp. Worm drive with worm and wheel running on roller bearings. Drive is fully inclosed and runs in bath of oil. Suitable for rapid handling of small loads in volume production. Electro Lift, Inc., 30 Church St., New York.

Heater Control

Safety unit for automatically lighting burners of gas-fired oven heaters or furnaces eliminates hazard of pilot flame failure. Consists of control cabinet and pilot thermocouple. After switch has been thrown to start unit and operator has started fan, the unit takes over control. The "Combustrol" can be operated in conjunction with electrically or air-operated automatic temperature control equipment. General Combustion Corp., West Wacker Drive, Chicago.

PRODUCE YOUR PRODUCTION TICKETS DIRECT FROM YOUR FIRST TYPING

NO STENCIL—NO TYPE



New DITTO DIRECT PROCESS DUPLICATOR *produces production tickets faster, better, at less cost . . . .*

THE new Ditto Direct Process Duplicator provides the ideal way to reproduce production tickets. Simply write or type your order once, take that original to the machine and reproduce all the copies you need.

If you may want to reorder the same styles and quantities at a later date, you file your original order and use it again to reproduce the necessary copies when they are needed. You will require no retyping and you can be absolutely certain that there will be no copying errors.

The Ditto Direct Process Duplicator makes copies through the use of Ditto Direct Process Liquid. The copies are bright, clean-cut and produced at remarkably low cost. Both hand and electric models are available and you can copy sheets up to 14 x 17 inches in size.

The savings effected by this method of reproducing production order tickets is well worth your careful investigation. Return the coupon for descriptive literature and samples showing just what this machine accomplishes. No cost or obligation.

DITTO, Incorporated
652 S. Oakley Blvd., Chicago, Illinois

Gentlemen: Please send me samples of production tickets reproduced on the new Ditto Direct Process Duplicator; also more information about this new Ditto machine.

*Name*_____ *Title*_____

*Concern*_____

*Address*_____

*City*_____ *State*_____ *County*_____

652 S. OAKLEY BLVD. DITTO, INC. CHICAGO, ILLINOIS

Cable Terminal

Has metal base with opening for multiple-conductor lead-covered cable and insulated studs to which conductors are attached. Studs project through the base to form terminals which are insulated with porcelain bushings. Plastic tubes insulate both terminals and conductors and a large tube insulates the entire assembly. There is an outer bronze housing. For voltages up to 7,500 and for cables up to 500,000 circ.mil. Electrical Engineers Equipment Co., Melrose Park, Ill.

Snow Plow

Model 200 snow plow can be attached to truck on tractor to clean yards and runways. It is reversible, has widening taper toward the rear. Height is 2 ft. at front, 3 ft. at rear. In case plow encounters obstruction, automatic device trips blade to permit plow to pass over. Blade is automatically reset. Good Roads Machinery Co., Kennett Square, Pa.

Engine

Type M 2-cycle oil engine in three cylinder sizes, 10x14 at 327 r.p.m., 12½x18 at 277 r.p.m., and 14x18 at 277 r.p.m. One to four cylinders for two smaller sizes, one to six for the larger. Horsepower ratings 30-360. All cylinders can be primed in any position; they are water jacketed their entire length. Forged connecting rods, automatic governor and injection pump in each unit. Anderson Engine & Foundry Co., Anderson, Ind.

Valve

Globe valve with disk seat available in materials for water, gas, oil, steam or compressed air service. Head carrying disk is integral with steam. Bonnet screws into body and carries stem threads. Seat makes line contact with disk near its outer edge by means of a recess around inside of seat. In ¼-in. units for 125-lb. pressure. Central Brass Mfg. Co., East 55th St., Cleveland.

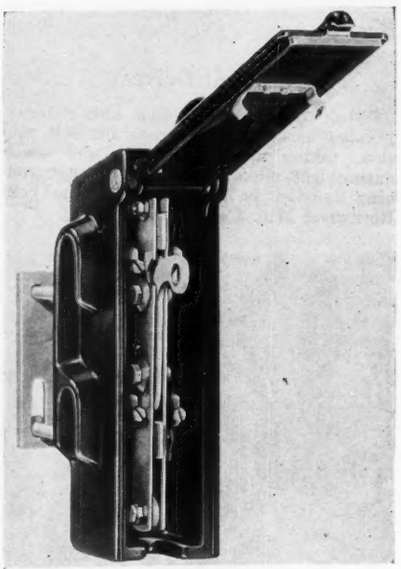
Temperature Controls

Line of electric temperature controls for heating, air conditioning, refrigeration, and processes. Line includes voltage thermostats, hydraulically operated motor valves for gas, oil, water, brine, or Freon. Sarco Co., Inc., 183 Madison Ave., New York.

Cabinet

Cabinet for storage of small parts is called "GF Holdsall." Made of steel and finished in olive green crinkle enamel, it has 10 drawers of varying height. Three drawers have fixed compartments, others have adjustable dividers which fit into slots spaced at 1-in. intervals. Dimensions: 20 3/16 in. wide, 30 3/16 in. high, 15 1/8 in. deep. Can accommodate parts 9¼x15¼x3¼ in. General Fireproofing Co., Youngstown, Ohio.

Switch



Porcelain-inclosed disconnect switch has cam-action blade of "dead hinge" type. It also has large protruding pull ring and adjustable hanger. Rated: 7,500 volts, 400 amp. No. C-353003-1. Line Material Co. South Milwaukee, Wis.

Tied Down by Custom?

No matter what bonding or rust-prevention process your company has been using these past years, you will want to look into this new Marks Bond process.

Your present equipment may be used. Saves time on processing. This bonding process has proven effective under many commercial tests and will give a satisfactory coating in 30 seconds. • It permits a saving on equipment space. • Saves on fuel and heating of tanks, requiring a solution of only 140 to 160 degrees. • Sludge practically eliminated. • Has passed salt spray and humidity tests. • Gives controlled etching—light or heavy. • Has been officially approved by several of Detroit's largest industrial plants.

WRITE FOR FREE DATA AND FREE TEST

Investigate and Save Money

MARKS BOND

Bonding Process CORPORATION

10401 NORTHLAWN AVENUE • DETROIT

Are Out-of-Date Hand Methods keeping your Maintenance Costs Too High?

MODERNIZE for Economy, with these three Low Cost Black & Decker Electric Tools

OPENING 2" HOLES IN A TANK for installing pipe lines with the Black & Decker ½-Inch Junior Drill and a Black & Decker Hole Saw. The ½-Inch Junior in the handiest size drill for maintenance work handles countless drilling jobs in wood, metal, composition, etc. With Black & Decker Hole Saws, it cuts clean, round holes from ¾" to 3½" diameter in any material a hacksaw will cut. The ½-Inch Junior Drill sells for **only $35.00.**

PROPER tools are just as essential in maintenance work as on the production line. Economical maintenance, too, shows up on the profit sheet. Check over your maintenance operations for the past six months. See how many were costly hand operations which could have been handled quicker, better, at lower cost, with Black & Decker Portable Electric Tools. Then ask your jobber to demonstrate the three tools on this page, and other Black & Decker Tools for maintenance work, right on the job in your plant—so you can make actual time and performance comparisons. Or write for complete information. Black & Decker Mfg. Co., 719 Pennsylvania Ave., Towson, Maryland.

REMOVING OLD PAINT with thenew B. & D. 7-Inch Junior Sander, the ideal tool for quickly smoothing and finishing metal and wood surfaces for painting —removing rust and paint —smoothing welds and casting ridges—rubbing down lacquer with felt pad, etc. Saves countless hours of hand work with sandpaper, emery, files, etc. A great value for **only $39.50.**

DRILLING TO REMOVE BROKEN BOLT with the Black & Decker ¼-Inch Junior Drill—one of the thousands of drilling operations in wood, metal and composition on which this inexpensive tool cuts the cost of maintenance work and speeds emergency repairs. The ¼-Inch Junior is a husky, powerful drill—built for years of service on intermittent work. Yet it costs **only $19.50.**

BLACK & DECKER

World's Largest Manufacturer of

PORTABLE ELECTRIC TOOLS

"Any possible comparison would favor American Hand Trucks"

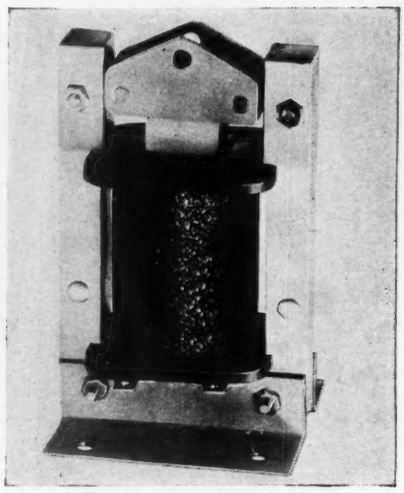
A statement like this pleases us—and *should interest any man who buys hand trucks.* It was made by the Philadelphia & Norfolk Steamship Company on the basis of actual experience with nearly 400 American Pressed Steel Hand Trucks. "The service on our piers is unusually severe," writes this user of "American" trucks. "We transport freight of almost every character, and we use our trucks for all sorts of purposes. Although these trucks are light in weight, well-balanced and easy running, they stand up well under the most severe conditions of service and we assure you that any possible comparison either of maintenance costs or length of truck life would be greatly in favor of 'Americans'."

There is an American Hand Truck to meet *your* particular material handling needs. The sooner you standardize on it—the greater your savings. Write today for the American Hand Truck Catalog and make *your* selection.

THE AMERICAN PULLEY COMPANY
4200 Wissahickon Ave., Philadelphia, Pa.

The labor saving, floor saving, rubber-tired, roller-bearing "American" hand truck wheel.

AMERICAN
PRESSED STEEL
HAND TRUCKS



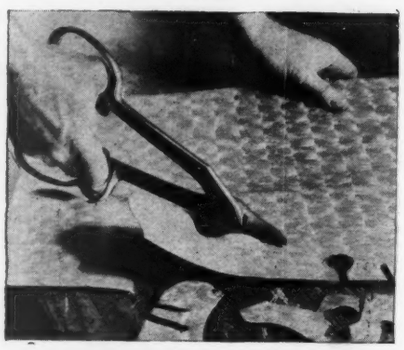
Solenoid

Solenoid has range of 24–220 volts d.c., 24–440 volts a.c. For a 2-lb. pull, ¾-in. stroke, 110 volts, 60 watts a.c. are required, 40 watts d.c. Plunger is 4¼ in. long, and plunger and core are laminated. Dimensions: 4x2½x2¼ in. Guardian Electric Mfg. Co., 1621-27 West Walnut St., Chicago.

Steel

High-temperature steel known as Sicromo 1, 2, 3, and 5 contains molybdenum. High silicon content gives oxidation resistance and chromium provides corrosion resistance. No. 5 is to be used where severe corrosion and oxidation are to be encountered, the other three numbers where conditions are less severe. Timken Steel & Tube Co., Canton, Ohio.

Shear

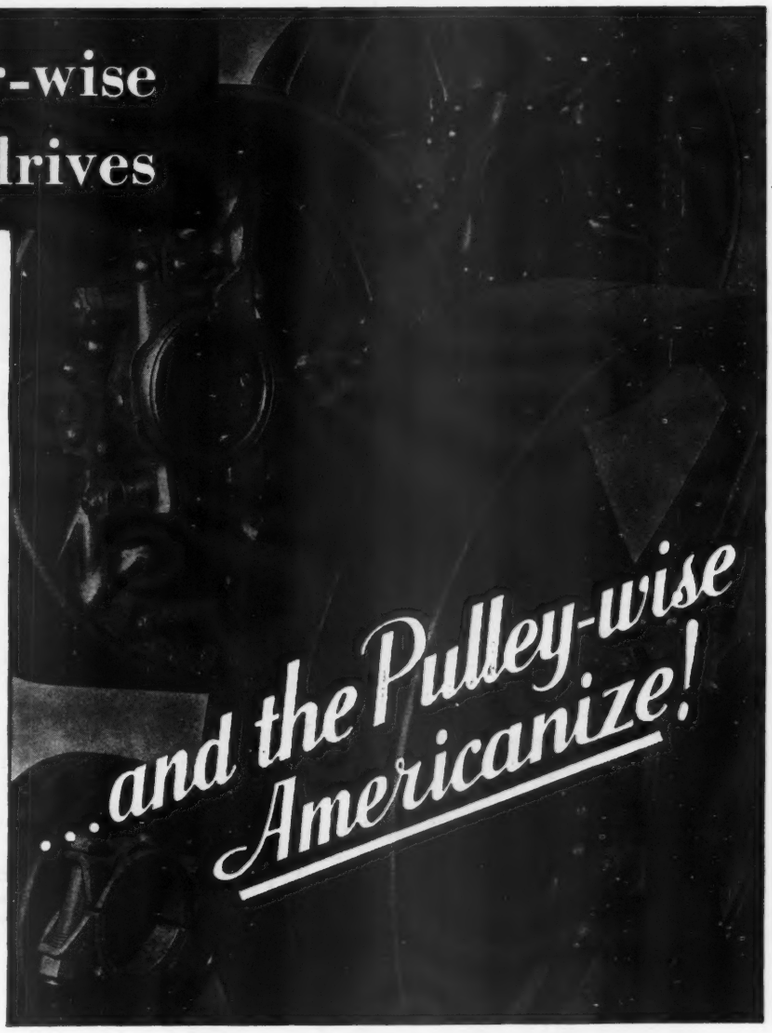


Metal cutting shears known as 9X "Scroll Pivoter" Snip cuts up to 17-gage metal and allows user to follow curves and angles without difficulty. Spring construction of bolt keeps shear in constant tension and adjustment, automatically taking up wear. Made of electric furnace steel. Is 12 in. long. J. Wiss & Sons Co., Newark, N. J.

Exhaust Box Conveyor

Flexible chain conveyor supports large-sized cans and moves them through exhaust box. Guide rails hold cans in position and chain is sufficiently flexible to permit several reverse turns. Chains are made of corrosion-resistant alloys. Speeds as high as 20 No. 10 cans per min. are claimed. Standard Conveyor Co., North St. Paul, Minn.

. . . The Power-wise Group their drives



*M*odern Group Drives have definitely demonstrated their advantages on a basis of economy and efficiency. So have AMERICAN STEEL SPLIT PULLEYS! To make the most of the former — investigate the merits of the latter. Save *two* ways — by being both *power-wise and pulley-wise.*

"AMERICANS" require less power to operate . . . at the start, because they are lighter . . . while running, because they cut the air. They reduce belt slip. They are easily installed — cost little, and represent a lifetime investment. An AMERICAN PULLEY is not a fire hazard—it will not burst destructively—and is free from face rivets that damage and destroy belting.

MODERN GROUP DRIVE PTC

Select *your* flat belt pulleys on a basis of true running qualities, strength, safe operation, good balance, high efficiency, long life—and "AMERICANS" *will be your* choice! AMERICAN PULLEYS are designed to meet modern production requirements on a better and more economical basis—*and they do!* The advantages of their split construction, interchangeable bushings, strength and lightness are reflected in daily production savings and by the yearly production profits of thousands of users. Write for descriptive literature today.

AMERICAN
PULLEY COMPANY
4200 WISSAHICKON AVE. PHILADELPHIA, PA.

AS MUCH AS 90%

Increase in Film Strength
Reduced Surface Tension
Lowered Temperatures
Increased Power Output

The decided improvement in operation effected when Pyroil is added to the regular lubricants used has caused the adoption of this famous super-lubricant by the largest industries and plants in this country and many others.

Pyroil readily proves its efficiency. Its corrosion inhibiting qualities alone make it desirable for the protection of many present day metals and alloys. Write for interesting facts. No obligation. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 268 La Follette Ave., La-Crosse, Wis., U. S. A.

Every Container Bears this Signature

Founder

SOFT ENOUGH FOR THIS

Onliwon Towels *are* soft enough to be welcomed by feminine cheeks—which makes them exceptional among paper towels. Yet this softness has been achieved at no sacrifice of absorbency and toughness. For these qualities are essential to any towel that must, as Onliwon does, pay its way through outstanding economy in actual use. Phone your local Onliwon representative today—and get the full story on how economically Onliwon Towels can improve *your* washroom service. Or, write for free samples to: A.P.W. Paper Company, Albany, N. Y.

A.P.W.

Onliwon Towels

You'll want a copy!

HANGERS • BEARINGS
COUPLINGS • CLUTCHES
V-BELT DRIVES • COLLARS
PILLOW BLOCKS • • • •

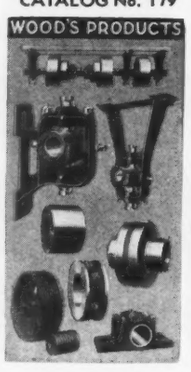
ON the alert for new sources of Saving?

WOOD'S Group Drive Equipment can cut your power losses! True running, long-lived and power stingy, every WOOD'S product operates economically with low maintenance cost.

Details? They're all in our Condensed Catalog No. 179 . . . send for your copy of this guide book to Saving!

Write today—there's no obligation!

ASK FOR CONDENSED CATALOG No. 179



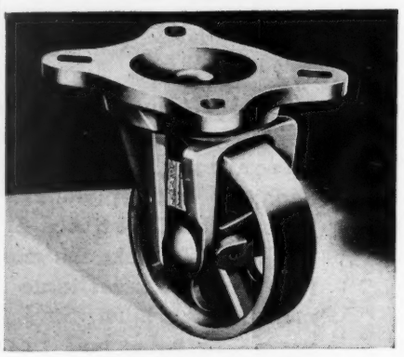
T. B. WOOD'S SONS CO.
CHAMBERSBURG, PA.
50 Church St., New York City 387-391 Atlantic Ave., Boston
MEMBER: The Mechanical Power Engineering Associates

Unit Heaters

Line of "Rocop" unit heaters. Seamless copper tube construction with no soldered steam joints. No. 2188 is rated 440 sq. ft. equivalent direct radiation, 1,450 cu. ft. per min. of heated air, 5 lb. steam. No 2186 rated 200 sq. ft., 783 cu. ft. per min., 15 lb. steam. No. 1414, medium-pressure type, rated 190 sq. ft., 556 cu. ft. per min., 5 lb. steam. Rome-Turney Radiator Co., Rome, N. Y.

Truck Casters

"Lo Wate" swivel and rigid truck casters for medium duty servie. Top plate and fork of swivel caster are machine castings of alloy iron. Single ball race, and legs are protected against breakage by two vertical ribs. Rigid caster is of same construction, and is of same height as swivel of same wheel size. Wheel sizes: 2½, 3, 4, 5, 6 in. Divine Bros. Co., Utica, N. Y.



Water Level Control

Boiler-water level control for boilers up to 1,000 sq. ft., pressures 20-150 lb. Has electrode mounted on gage glass water column and connected to electric relay. As water level drops below long electrode, relay opens valve until water rises to shorter electrode, when current is cut off. The Johnson Corp., Three Rivers, Mich.

Lock

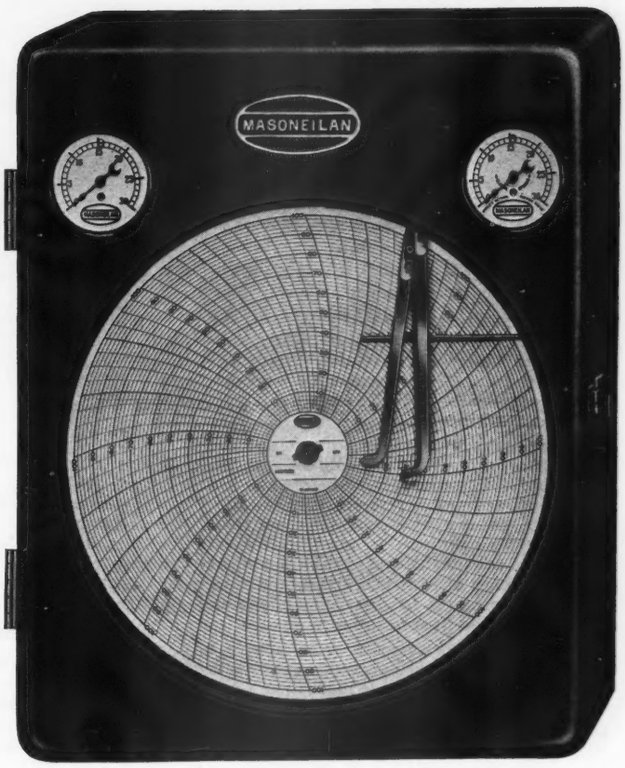
Cylinder "Duo Lock" has two sets of tumblers and each set must be operated by separate part of the key. The lock is said to be practically impossible to pick, has vast number of key changes. Two designs: one is die cast cylinder with brass barrel; other is brass cylinder and barrel with hardened steel inserts. The Illinois Lock Co., 737 West Jackson Blvd., Chicago.

(Continued on page 94)

A Profitable Investment

THE NEW MASONEILAN CONTROLLER

This new Masoneilan Air-Operated Controller embodies the latest developments in exact process control. Important improvements in design and construction, application of the same control system to temperature pressure, rate of flow, or liquid level; accuracy and uniformity of operation—are characteristics of this controller which make it a profitable investment wherever sensitive, exact control is a cost factor.



MASONEILAN

CHECK THESE FEATURES

1. All parts are accessible and standardized.
2. All adjustments are visible and made without disturbing the chart record.
3. Sensitivity may be changed over the entire range without upsetting control.
4. Control valve diaphragm pressure may be changed without shifting control point.
5. Adjustable reset to synchronize the control system with the speed of process—hand knob and graduated dial.
6. Accurate setting is provided by direct indication on the chart.
7. The system may be placed under remote manual control without interfering with the chart record.
8. Low operating cost, due to standardized interchangeable parts, sturdy construction and minimum air consumption.

MASON-NEILAN REGULATOR CO.

1194 ADAMS STREET, BOSTON, MASS.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH TULSA

WHEN YOUR FIRST BABY CAME—

Did You Have to Borrow to Pay the Bill?

Most wage earners need extra cash at times to meet emergencies — At Household Finance they can borrow without embarrassment and at reasonable cost

● How proud you felt when your first baby was born! But with your joy and pride probably came money worries—how to pay the doctor, the nurse—all those emergency expenses of parenthood that you couldn't meet out of current income.

Today many of your employees have the same money problems that troubled you when you were still on the way up—before you had had time to accumulate reserves. Births, deaths, accidents, unexpected losses — to meet these demands for cash *you* can now borrow on negotiable collateral at your bank. But many families—many of your employees—can offer only their promise to pay. Someone must loan to them on their future earning capacity.

Household Finance gives these people a place to borrow on a dignified, business-like basis. During 1936 it made more than a half million loans to small-salaried families in need of cash for emergencies.

Families returned to solvency

To thousands of families Household Finance rendered another important social service. Our "Doctor of Family Finances" encouraged and promoted Home Money Management—showed families how to budget their incomes, how to buy better, how to return to solvency by stopping money leaks. Aided by this counsel many of these families succeeded in getting out of the financial rut for good.

We believe that executives interested in the welfare of their employees will find samples of the publications used in this educational work interesting and revealing. We will gladly send you copies without obligation. Please use this convenient coupon.

HOUSEHOLD FINANCE CORPORATION

and Subsidiaries **— one of the leading family finance organizations, with 214 offices in 148 cities**

HOUSEHOLD FINANCE CORPORATION, Dept. FM-1
919 N. Michigan Ave., Chicago, Ill.

Please mail me without obligation booklets and full information on Household Finance's family reconstruction program.

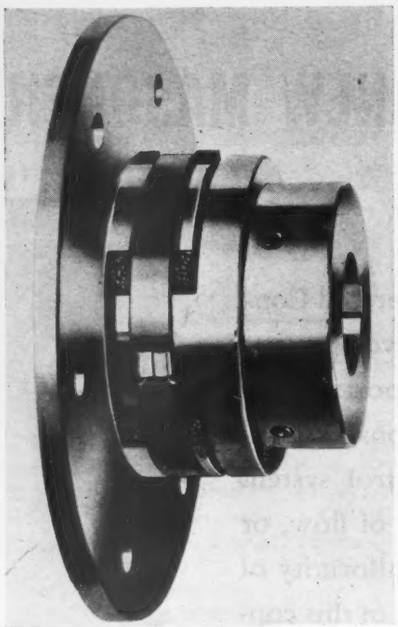
Name.....

Address.....

City..... *State*.....

Flexible Coupling

Type WF flexible coupling has one body in form of a flange which bolts onto flywheel, clutch, or brake drum of engine. Short overall length. Sizes 3-16-in. bores, suitable for 2,500 hp. at 100 r. p. m. Free-floating load cushions are held in place by quickly removable outside retaining spring. Load cushions can be replaced



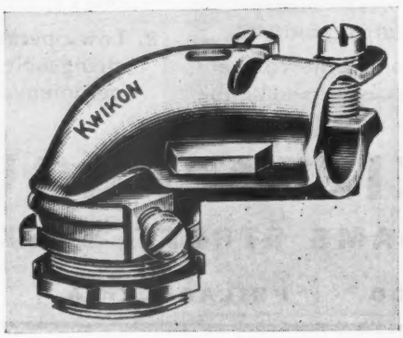
without tearing down coupling. Three types of cushioning material: Metalflex, a brake lining material, for heavy shock loads; leather, oak tanned belting leather, for sustained loads; Multiflex, a rubber duck fabric, for fluctuating loads. Lovejoy Tool Works, 4963 West Lake St., Chicago.

Psychrometers

Two. One is fan type, other sling. Operator can carry former to any part of the plant and make relative humidity determinations. Sling type has its metal parts of monel and its thermometers are 9½ in. long with range of —20 to +120 deg. F. in 1-deg. graduations, or 0 to 100 deg. F. in 0.5 deg. markings. G. M. Mfg. Co., Inc., 21–16 44th Rd., Long Island City, N. Y.

Connector

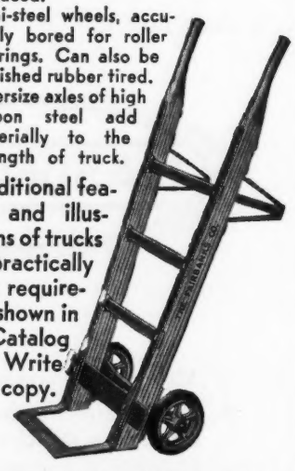
"Kwikon Swivel Box Connector" can be adjusted from outside the transformer or other box-inclosed device to which it is attached. Body rotates on swivel while threaded shank remains rigid. It is set at desired angle by means of setscrew located outside the box. Kwikon Co., 630 West Jackson Blvd., Chicago.



A LIFETIME HAND TRUCK

Here's something new, something different in Hand Trucks. Just note these outstanding features and we think you will agree that Fairbanks No. 9000 Patented Hand Trucks *should* last a lifetime.

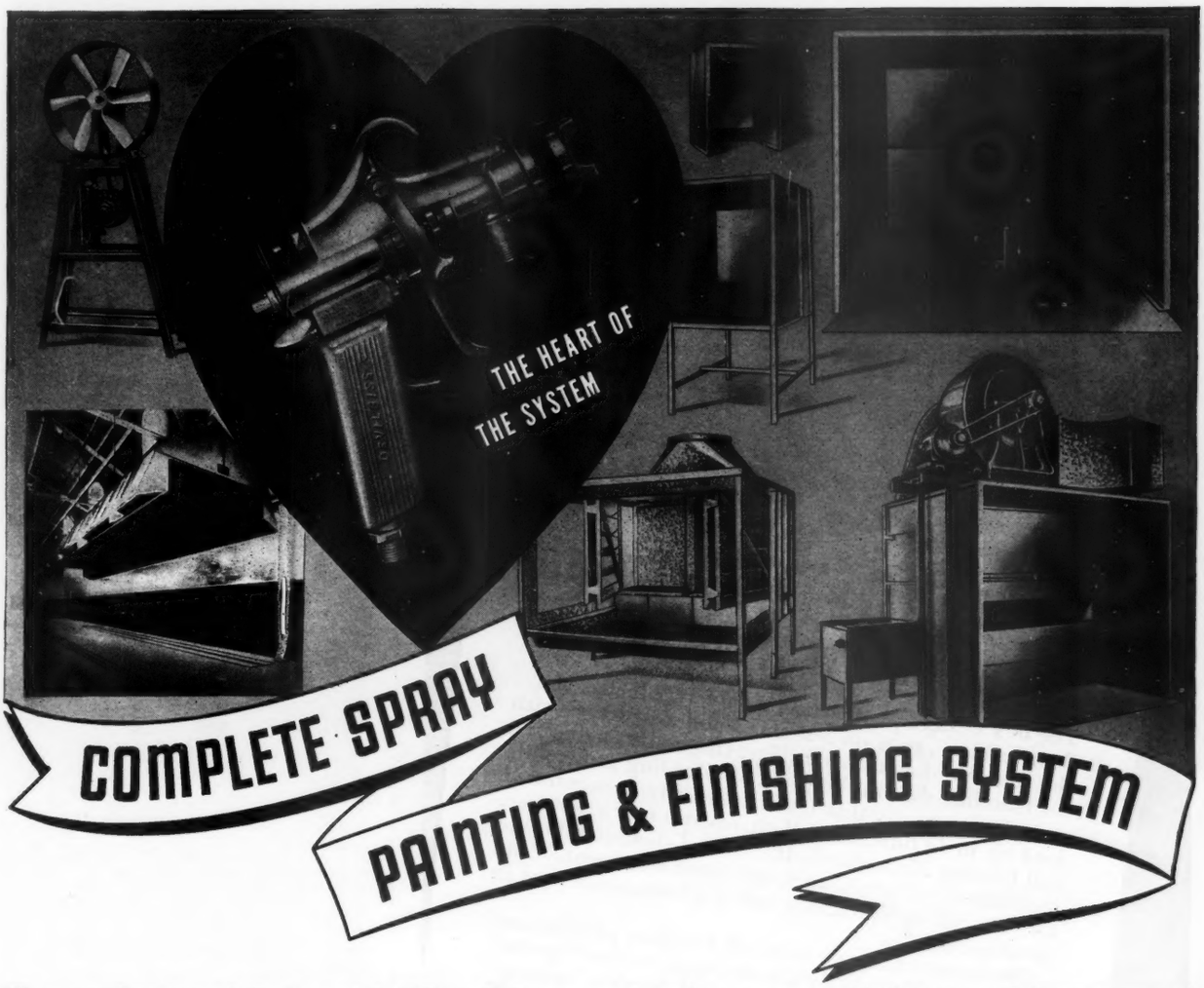
1. Continuous well seasoned wooden frame for flexibility and strength; will not buckle or bend out of shape.
2. Formed steel legs and braces, for increased strength and stiffness.
3. Steel straps on both *front and back of frame*, provide extra strength, rigidity and durability.
4. Channel-shaped pressed steel cross bars set flush into top of wooden frame and rigidly bolted, eliminating mortising of handles.
5. Frame tapered to provide better balance and ease of handling.
6. Wide flat steel combination lower cross bar and wheel guard.
7. Separate electrically welded nose iron *over* the handle straps; easily replaced.
8. Semi-steel wheels, accurately bored for roller bearings. Can also be furnished rubber tired.
9. Oversize axles of high carbon steel add materially to the strength of truck.



Additional features and illustrations of trucks for practically every requirement shown in our Catalog 955. Write for a copy.

The Fairbanks Co.
Hand Trucks, Wheelbarrows, Valves and Dart Unions
401 Lafayette St., New York, N. Y.
Boston — Pittsburgh
Distributors in Principal Cities.
Factories: **Binghamton, N. Y., Rome, Ga.**

Fairbanks Hand Trucks



The completeness of the line of DeVilbiss Exhaust Equipment is typical of the entire DeVilbiss Spray-Finishing System—a system so complete that it includes every item of equipment needed for the application of better finishes in less time and at lower cost.

Years of study, experience and service to industry have enabled us to solve the problems of thousands of finishing departments through the installation of exhaust systems. The requirements of industry vary so greatly that it has been found necessary to develop many different types of exhaust—including the simple direct type of exhaust, the indirect type, the downdraft type, the dry reclaiming type, the water wash type and the canopy type.

Each of the various types of DeVilbiss Exhaust Equipment has been especially designed to do, most efficiently, the job for which it is recommended. It is not just a booth, fan and exhaust pipe put together, but is engineered for the perfect functioning of these carefully balanced parts as a unit. From these different types of DeVilbiss Exhaust Equipment can be provided an installation that will most satisfactorily serve your requirements. Should, however, you have a condition that cannot be met by one of the standard types, the facilities of our engineering and research departments are always available.

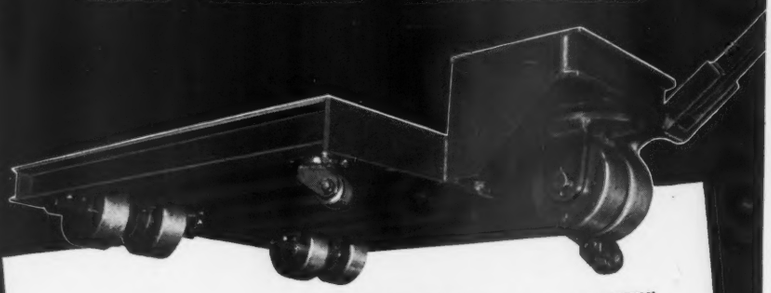
SPRAY GUNS
MATERIAL CONTAINERS
REGULATORS
SPRAY BOOTHS
EXHAUST FANS
HOSE AND CONNECTIONS
AIR COMPRESSORS
ACCESSORIES

DeVilbiss

★ THE DEVILBISS COMPANY · TOLEDO, OHIO · U. S. A.

Sure can take it!

ANY WEIGHT—ANYWHERE

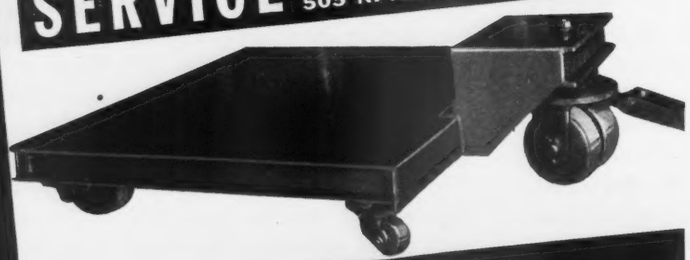


HANDLES 30-TON LOAD WITH THE GREATEST OF EASE

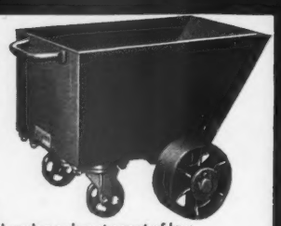
The 6' x 6' steel platform . . . only 12⅞ inches above floor level . . . rests on a beamed under-structure with the stamina of a railroad bridge. Originally engineered for handling dies in the plant of a leading automobile manufacturer . . . this truck takes any concentrated load up to 30 tons and rolls it easily on friction-free, full bearing 12x5 wheels. It's a broad-shouldered brute that thrives on heavy work and rough treatment. Write for detailed specifications and performance record in various fields.

No matter what your materials-handling problems and needs, there's probably a field-tested Service "special" that will meet them. Note typical Service "specials" illustrated below. They handle unusual jobs unusually well. Check their application to your hauling problems.

SERVICE CASTER & TRUCK CO.
505 N. Albion St., Albion, Mich.



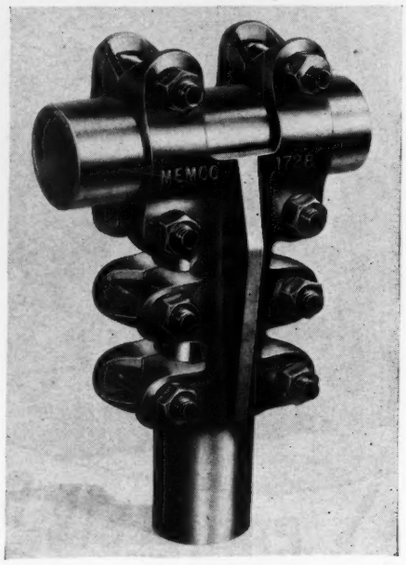
Developed for rapid handling of heavy packages. 30" x 60." The three sides extending up 36" above platform are of 16-gauge perforated metal.



This small Dump Truck slips into tight corners and under exhaust-spout of low machines. 10-gauge steel hopper measures 12"x 18" at mouth and 12"x 12" at bottom.

Connector

Senior "Pli-A-Band" connector connects tubing to tubing, tubing to cable, cable to cable. Available in standard sizes, made of resilient copper alloy. It has interconnected clamping bands, and is said to make connector-to-bus contact having minimum potential drop and low temperature rise. Memco Engineering & Mfg. Co., Inc., 3746 Ninth St., Long Island City, N. Y.

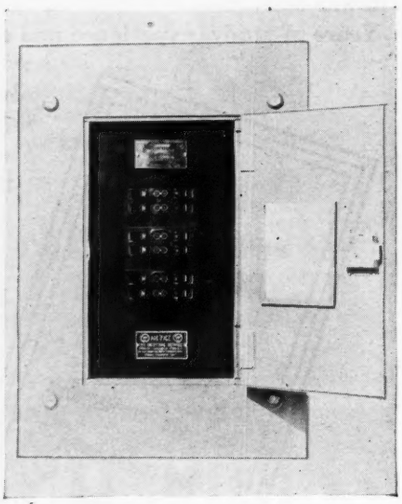


Sawing-Setting Jig

With it teeth can be set on circular wood-cutting saws 8-24 in. in diameter. It is claimed saw can be set with sufficient accuracy to make glue joints without side dressing. Can be used on rip or cutoff saws. G. M. Diehl Machine Works, Wabash, Ind.

Panelboard

"Nofuze" panelboard for general 115—, 115/220-volt a. c. distribution with branch circuits ranging 15-50 amp. capacity. Range of 4-40 circuits in 2-circuit steps. Bus arrangements for single-phrase, 3- and



2-wire, and 3-phase 4-wire services. Branch circuit ratings of 15, 20, 25, 35, and 50 amp. Multi-breaker units. Box dimensions: 15 in. wide by 4 in. deep. Westinghouse Electric & Mfg. Co., East Pittsburgh.

INE DUST CALLED
MOST DANGEROUS
Prof. Drinker Advises Industry on Fight
PITTSBUGH Nov. 15 (AP)—Prof.
Philip Drinker of Harvard advised
industry today to center its fight
against dust hazards of the tiny par-
ticles that can be breathed and re-
tained by the lungs of workmen.
He declared in a report to the air
hygiene foundation of America that
the larger dust particles tend to fall
from the air by their own weight and
are less likely to be breathed.
The finer dust he said, the greater
the potential danger to health in
mines, the mills and the working
Prof. Drinker is chairman
committee of the
he wrote his report
technical specialists

FRESH, CLEAN AIR

thanks to Coppus Filters

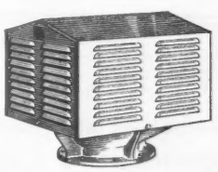
Against 10 micron size dust particles, 99.9% efficient . . . against 2 micron size dust, 95.6% . . . these are the dust arrestance ratings that can be obtained with Coppus Air Filters. (A micron is 1/25 of 1/1000 of an inch.) Dust count and light reflection tests show no other commercial filter can maintain such a high degree of efficiency.

Coppus Air Filters — dry-type, no oil; steel construction, no wires; wide pockets, no clogging. You can obtain the degree of cleanliness you need — for protection of machinery, healthful working conditions, product purity, saving in cleaning cost, recovery of valuable substances in the air. Write 375 Park Ave., Worcester, Mass., for Bulletins.

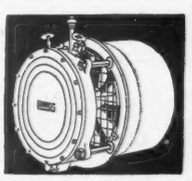
In manholes or in *any* confined working space: tunnels, pipe galleries, coal pockets, process tanks, storage bins, etc., the *Cable Manhole Ventilators* (Bulletin 163).

For rapid cooling and ventilating of boilers, tanks, retorts, etc., the *Boiler Manhole Blower* (Bulletin 161-3).

For directing a flow of cool air upon workmen (also cooling off furnaces, ventilating motors, generators, etc.), the *Heat Killer* (Bulletin 160-4).



Attached to the intake of air compressors and engines, the Coppus Air Filter provides clean air, free from abrasive dust particles. (Bulletin F-310-3).



To increase boiler capacity or to improve draft conditions, the *Forced Draft Blower* (Bulletin 145-5).

For bulletins, address COPPUS ENGINEERING CORP., 375 Park Ave., Worcester, Mass.

CLEAN AIR FOR MEN AND MACHINES COPPUS

COPPUS ENGINEERING CORP. Branches and representatives in principal cities — see listing in THOMAS' REGISTER. In SWEET'S — Air Filters, Blowers, Heat Killers, Mine Ventilation Equipment, Steam Turbines.

Keep the Packing Room Safe and Clean WITH VACUUM

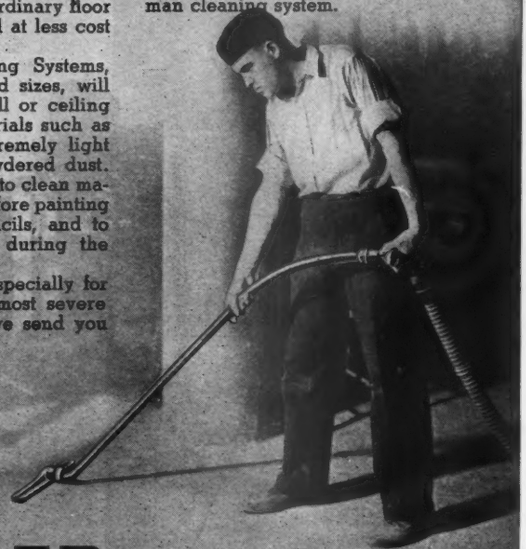
Vacuum cleaning in the packing or shipping room has three distinct advantages: It protects the employees; it keeps dust away from the finished goods and containers, and it does the ordinary floor cleaning quicker, better and at less cost than any other method.

Spencer Vacuum Cleaning Systems, designed in many types and sizes, will clean any kind of floor, wall or ceiling surface; remove bulky materials such as sand or coal dust, and extremely light materials such as lint or powdered dust.

Spencer Systems are used to clean machinery, to clean products before painting or finishing; to remove stencils, and to pick up or hold materials during the manufacturing process.

These systems are built especially for long-life service under the most severe industrial conditions. May we send you the bulletin?

A single unit is readily piped to all floors of any building, and light-weight vacuum hose, connected to special Spencer Vacuum Tools, provides a universal one-man cleaning system.



SPENCER HARTFORD CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

WIRE

Round—Flat—Half Round
Straightened and Cut
Shape Wire

HIGH CARBON SPRING
LOW CARBON BASIC AND
BESSEMER OIL TEMPERED
WELDING WIRE RODS AND COILS

Sizes ½" to No. 40 WM Gauge (.007)—All Finishes

Wire for Practically All Purposes and Requirements also SCREEN WIRE CLOTH

Highest Quality and Service Guaranteed

Established 31 Years

IRON STEEL ALLOYS WIRE "SENECA" TRADE MARK

The Seneca Wire & Mfg. Company
Fostoria, Ohio

Representatives and Warehouses in practically all principal cities

CHICAGO RAWHIDE
Mechanical Leather
PACKINGS

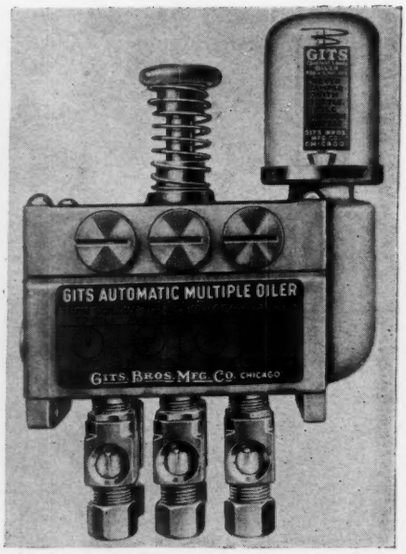
for leakage and power losses . . .

for greater accuracy of size, shape and thickness; for packing engineered to specific pneumatic or hydraulic pressures. Specify "Chicago Rawhide" for longer life and fewer shutdowns . . . for *mechanical* leathers, *mechanical* tannages and treatment that give exactly controlled hardness, resiliency, heat resistance, friction; pressure resistance; flexibility and tensile strength. Standard and special shapes on short notice. Technical recommendations furnished.

CHICAGO RAWHIDE MFG. CO.
1295 Elston Ave., CHICAGO
U. S. A.

Branches:
New York Boston Philadelphia Pittsburgh Cleveland Detroit Cincinnati St. Louis

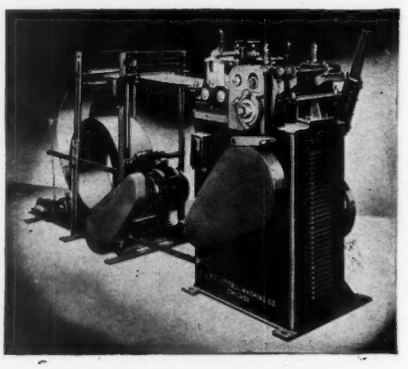
Oiler



Type MH multiple oiler with 2–12 sight-feed drip leads. For each lead there is a gravity-fill cup which is carried by a plunger below oil surface to be filled. As cup rises it delivers 1–10 drops of oil to its lead. Constant-level reservoir in 8-oz. capacity or less maintains oil level. Sight glasses in the leads are non-breakable. Gits Bros. Mfg. Co., 1855 South Kilbourn St., Chicago.

Press Feed

Motor-driven feeding unit delivers coiled stock to double-action presses. Feeds required amount of stock into press each time it is tripped. Equipped with 5– or 7–roll straightener. Power-driven stock reel has automatic shutoff to prevent loop of material from becoming too large. Unit is mounted in rigid welded steel base. F. J. Littell Machine Co., Ravenswood Ave., Chicago.



Grinder

Portable grinder for light-grinding, buffing, and polishing operates at 3,600 r.p.m. and mounts 6x1-in. wheel. Driven by 1-hp. motor on 220-volt, 3-phase, 50- or 60-cycle current. Has double-throw, 2-pole switch mounted in handle. Equipment includes wheel guard. Overall length is 20 in. Sawyer Electrical Mfg. Co., 1124 East Slauson Ave., Los Angeles.

Insulating Material

"Block Baked" insulating corkboard. Made in blocks up to 36x40 in., and in thicknesses of 1–16 in. Blocks are flexible

The International I-12 Tractor with this lift truck built on it, readily picks up, transports, and lays down loads of various kinds. It is shown here removing loaded skids from trailers in the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific.

An Efficient Materials-Handling Unit

International I-12 with Lift Truck

A real help in solving materials-handling problems is offered by the International I-12 Industrial Tractor equipped with lift truck shown above.

In the Milwaukee, Wis., shops of the Chicago, Milwaukee, St. Paul & Pacific, this outfit is used by the stores department to move materials. It picks up loaded skids weighing approximately 2,000 pounds each, puts them on trailers, tows the loaded trailers to the shipping and receiving departments, and unloads the trailers. Incoming supplies are loaded on the trailers and distributed to the proper departments. Each International has a scheduled circuit to travel every morning and afternoon.

Investigate the International I-12 for your work. It is small and compact for working in close quarters, and it is noted for its operating economy. It works alone or in combination with equipment built around it. The nearest International industrial dealer, or Company-owned branch, will give you complete information on this tractor or other industrial wheel and crawler-type tractors in the International line.

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
606 So. Michigan Ave. Chicago, Illinois

INTERNATIONAL HARVESTER